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# IMPACT OF NEW TECHNOLOGY WEAPONS ON SAC CONVENTIONAL AIR OPERATIONS

by

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Cut Along Dotted Line

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Research Report No. AU-ARI-83-4

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ON SAC CONVENTIONAL AIR OPERATIONS

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Clyde E. Bodenheimer  
Colonel, USAF  
Research Fellow, ARI



Air University Press  
Maxwell Air Force Base, Alabama

June 1983

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*Woe to the government, which, relying on half-hearted politics  
and a shackled military policy, meets a foe who, like the  
untamed elements, knows no law other than his own power!*

*Carl Von Clausewitz*

# CONTENTS

<u>Chapter</u>		<u>Page</u>
	DISCLAIMER-ABSTAINER-----	ii
	FOREWORD-----	xi
	THE AUTHOR-----	xiii
	PREFACE-----	xv
	EXECUTIVE SUMMARY-----	xvii
I	A CONVENTIONAL RESPONSE CAPABILITY-----	1
	The Strategic Projection Force-----	2
	Technological Change-----	4
	Roles and Missions for LRCA-----	6
	Conventional Issues-----	7
	Purpose of Study-----	8
	Organization of Study-----	8
	Scope of Study-----	8
	Notes-----	12
II	A HISTORICAL PERSPECTIVE-----	14
	The Doctrine Formulation Period 1930-1941-----	14
	World War II-----	16
	The Strategic War in Japan-----	20
	World War II Weapon Systems-----	22
	Nuclear Weapons-----	23
	Korean War 1950-1953-----	24
	The Strategy of Massive Retaliation and Assured Destruction 1953-1965-----	25
	Vietnam 1965-1973: Second Employment of the Bomber in the Nuclear Age-----	29
	Summary-----	31
	Notes-----	32
III	POLICY, STRATEGY, AND GUIDANCE-----	36
	Policy-----	37
	Strategy-----	39
	Guidance-----	40
	Notes-----	43
IV	ATTRITION AND TECHNOLOGY-----	45
	World War II-----	45
	Korea-----	46
	Vietnam-----	46
	The Falklands-----	46
	Lebanon 1982-----	49
	The High-technology Approach-----	51
	Notes-----	54



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V	NEW TECHNOLOGY WEAPONS FOR CONVENTIONAL CONFLICTS---	57
	Soviet Defense Threat-----	59
	Soviet Ship-launched SAMs-----	60
	Survivability and Weapons Effectiveness-----	60
	Existing Weapon Options-----	68
	Near-term Weapon Options-----	70
	Far-term Weapon Options-----	72
	Summary-----	76
	Observations-----	77
	Notes-----	78
VI	POTENTIAL FOR THE FUTURE-----	83
	Technology Balance-----	83
	Potential Areas of Involvement-----	87
	A Question of Strategy-----	99
	Existing Forces-----	102
	Projected Strategic Bomber Force Structure-----	103
	Sensors--Autonomous or Cooperative?-----	107
	Standoff Weapons--A Force Multiplier-----	109
	A Dedicated Conventional Bomber Force-----	109
	Considerations for a Conventional Bomber Force---	111
	Employment Scenarios-----	111
	Summary-----	121
	Notes-----	122
VII	DECISION TIME-----	126
	Technology Explosion-----	127
	Observations on Weapons Acquisition-----	127
	Observations on Bomber Force Structure-----	128
	A Modern Maginot Line-----	129
	Future Directions-----	129
	Notes-----	131
	APPENDICES:	
	A: Expanded Information on Soviet Land-based SAMs	132
	B: Expanded Information on Soviet Ship-based SAMs	136
	C: DOD Research and Development of Electronic Systems-----	139

## ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
<u>Chapter I</u>		
1-1	Nonnuclear Weapons Carriage-----	3
1-2	Long-range Combat Aircraft-----	10
<u>Chapter V</u>		
5-1	Soviet Surface-to-Air Missiles-----	61
5-2	Soviet SAM Envelope (Estimated)-----	64
<u>Chapter VI</u>		
6-1	Funding for Technology Base-----	84
6-2	Technology Matrix-----	86
6-3	Middle East and Southwest Asia-----	89
6-4	East Asia and the Pacific-----	91
6-5	Principal Suppliers of Critical Minerals-----	93
6-6	Africa-----	95
6-7	Latin America-----	97
6-8	Middle East-----	98
6-9	Western Europe, NATO, and the Warsaw Pact-----	100
6-10	Planned Strategic Bomber Force Structure-----	105
6-11	USAF Bomber Force Inventory-----	106
6-12	Factors to Consider in Scenario Selection-----	113
6-13	Iraqi Invasion Plan-----	116
6-14	Indo-Soviet Invasion Plan-----	118
6-15	DCBF Operational Requirements for Armed Surveillance/Initial Strike in Maritime Role--	119
6-16	Corridor Patrol and Armed Surveillance-----	120



# TABLES

<u>Table</u>		<u>Page</u>
1	Search and Surveillance-----	140
2	Target Acquisition and Fire Control-----	141
3	Communications and Navigation-----	142
4	Command and Control-----	144
5	Electronic Warfare-----	145
6	General Support Technologies-----	146

## FOREWORD

The issue of whether to use the strategic bomber in conventional warfare has only arisen since the dropping of the nuclear bomb on Hiroshima and Nagasaki in World War II. Before that time the bomber armed with conventional weapons was the key factor in determining the outcome of war. When the Strategic Air Command was formed in 1946, the strategic bomber was thought to be a "nuclear only" delivery vehicle. The situation in Korea and Vietnam again pressed the strategic bomber into conventional operations, but only with much reluctance. In all three wars the bomber was effective and proved a decisive factor in the securing of our national objectives. However, we did pay a price. Over Ploesti, Schweinfurt, and North Vietnam our bombers felt the impact of heavily defended targets. Aircraft attrition was high throughout World War II and heavy during the first three days of Linebacker II. The defenses we will face in the future will be even more dangerous than anything we have seen before. We must find a solution to this problem.

Because of the situations and tensions in the world today, the United States is facing the possibility of involvement in a conventional conflict on a worldwide basis. The US dependence on critical energy resources and strategic minerals could be the catalyst for triggering such a conflict. The vulnerable sea lines of communications (SLOCs) over which these goods are delivered must be protected and remain secure. To accomplish this objective, the United States must have a rapidly deployable force projection capability. Our need is not just a force that can get there quickly, but one that is a determining factor in battle and can survive to fight in multiple areas.

The strategic bombers of today have the range to reach almost any point on the globe. Unfortunately, they are loaded with World War II type gravity weapons that are ineffective against many of the targets they might have to attack. Coupled with these weapons is the need for adequate sensors to locate, classify, and identify moving and fixed hard targets as well as ships at sea. A difficult task indeed and beyond the capability of the current strategic bomber sensors.

There are three issues, aircraft attrition in conventional warfare, the requirement for rapid and effective force projection, and an aging arsenal of ineffective conventional weapons, that come under scrutiny in this monograph on the "Impact of New Technology Weapons on SAC Conventional Air Operations."

Colonel Bodenheimer applies his combat experiences, extensive knowledge of the Air Force acquisition process, and personal involvement in new technology weapons development to his treatise of these issues. In this single unclassified monograph he has provided an expanded view of how the strategic bomber could be used effectively in the conventional force projection or maritime role. The observations and recommendations he makes on new technology weapons and restructuring of the

bomber force to form a dedicated conventional bomber force (DCBF) are extremely germane to the issues we face today in the Air Force. He has presented the facts and issues; now it is time to act.



DONALD D. STEVENS  
Colonel, USAF  
Vice Commander  
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## THE AUTHOR

Colonel Clyde E. "Ed" Bodenheimer began his observations on the effectiveness of conventional bombing as a forward air controller at Nakon Phanom in Southeast Asia in 1970. A total of 300 combat missions in many different aircraft, the OV-10, KC-135A and Q, B-52D and G, added first-hand experience in conventional operations to his 21 years of operational assignments. Colonel Bodenheimer served as a bomber planner in 1972 with the Eighth Air Force (Guam) plans division for the Linebacker II raids on North Vietnam. He was later the operations officer and then commander of the 71st Air Refueling Squadron (SAC). Assigned to Strategic Air Command Headquarters in 1979, he served as acting chief, Air Vehicles Division and then as chief of the Advanced Development Division. In both assignments he continued his involvement and activities in strategic aircraft development and advances in new technology conventional weapons.

Colonel Bodenheimer researched and wrote this monograph while serving as a SAC-sponsored senior research fellow in the Airpower Research Institute, Center for Aerospace Doctrine, Research, and Education, Air University. He holds a bachelor's degree from Oklahoma State University and a master's degree from Troy State University. He is a graduate of the Air Command and Staff College (1973), Industrial College of the Armed Forces (1976), and the Air War College, class of 1983. Colonel Bodenheimer is currently assigned as the deputy director, Aeronautical Requirements Directorate, Headquarters Strategic Air Command.

## PREFACE

As a forward air controller (FAC) in Southeast Asia, I was able to observe or deliver almost every kind of air-to-ground weapon in the Air Force inventory available at that time. I also saw the losses of aircrews and aircraft that we incurred due to the requirement to overfly the target areas to deliver these weapons. It occurred to me, while firing 2.75-inch marking rockets, that we should be able to accurately deliver weapons from outside the lethal ranges of enemy ground defenses. I was encouraged when I saw precision delivery of paveway laser guided bombs (LGB) and GBU-15 (TV) bombs. One bomb, one target. We had great accuracy but we still faced the same AAA and SAM threats as before. We needed accuracy and range. But technology was not capable of providing a solution before the termination of that conflict.

In the following years of my career, I was fortunate to be assigned to SAC Headquarters in DCS Plans and Programs, Directorate of Aeronautical Requirements. In that capacity I was exposed to the technology revolution that we are experiencing today. Tremendous advances were made in the areas of avionics, navigation systems, weapons delivery, and guidance systems. Not only were the new strategic bombers getting better, but we now have the technology to build effective conventional long-range standoff weapons. Unfortunately, in 1983, few of these weapons are actually in the field or in production.

In this unclassified monograph, I have tried to present, as unbiased as possible, what I view as a major problem in the Air Force today. Current guidance says that we should be able to project forces rapidly, with sufficient firepower to stop or blunt an attack anywhere in the world. This study attempts to delineate the obstacles we must face in developing that capability. New technology conventional weapons combined with strategic bombers are proposed to overcome some of those obstacles. Hopefully this message will reach as broad an audience as possible, and we can make the required decisions to change technology into hardware.

I want to thank General Bennie L. Davis, Commander in Chief, Strategic Air Command, for allowing me the opportunity to express some of my thoughts on this subject and selecting me to participate as a command-sponsored senior research fellow with the Airpower Research Institute at Maxwell AFB, Alabama. My appreciation also goes to Lieutenant General George Miller, Vice Commander, Strategic Air Command, and Major General Monroe Hatch, Chief of Staff, Strategic Air Command, for their personal encouragement and support.

Special acknowledgement is extended to three Air Command and Staff College course officers whose research efforts allowed more comprehensive coverage of the subject than I alone could have accomplished in the time available. My personal thanks to Majors Russ Larson, Harry Kingsbury, and Denver Robinson. This project could not

have been complete without the efforts of all the editorial staff at the Airpower Research Institute--John Schenk, Dorothy McCluskie, Jo Ann Perdue, Marcia Williams, Edna Davis, and Connie Smith. My editor at the Air University Press, Agnes Wallner, deserves much credit for her patience and meticulous review of this entire manuscript.

Finally, a very special thank you to my wife and daughters, Brenda, Brett, and Heidi, who waited patiently in Nebraska for me to complete this long, difficult but rewarding year.

A handwritten signature in cursive script, reading "Clyde E. Bodenheimer".

CLYDE E. BODENHEIMER, Colonel, USAF  
Senior Research Fellow (SAC)  
Airpower Research Institute

## EXECUTIVE SUMMARY

This entire study has been kept unclassified for maximum distribution. Specific numbers and technical details are not presented, but that should not detract from the problem which is to be emphasized. The problem is that the Air Force today does not have a rapid deployment capability which can stem the tide of battle in the early stages of hostilities without suffering unacceptable losses. The strategic bomber, equipped with new technology conventional standoff weapons and modern sensors (RADAR), could avoid the attrition issue and provide a rapidly deployable, autonomous force for the land attack or maritime support anywhere in the world.

Chapter I introduces the issue of conventional response capability. The point stressed first is that the strategic bomber's primary mission is in support of the single integrated operations plan (SIOP) as a nuclear weapons delivery vehicle. However, as cited by Secretary of Defense Caspar Weinberger, we must have a rapid deployment conventional capability to areas where there are small if any US forces present. The SAC strategic projection force (SPF) is available but with gravity weapons of World War II vintage. New technology can provide answers to the problem by providing highly accurate long-range conventional stand-off weapons. The chapter emphasizes that the SAC conventional role for strategic bombers will become even more important.

Chapter II gives a basic historical perspective on the use of the strategic bomber in past wars. It discusses the development of strategy, weapons, and targets in World War II, Korean War, and Vietnam War.

Chapter III presents a very brief look at current US policy, strategy, and guidance. Emphasis is on the President's strategic forces modernization plan to correct the neglect of the past 20 years. The modernization of the bomber is a key point in this plan.

Chapter IV covers the aircraft attrition issue in today's highly lethal defensive environment. It details the bomber attrition rates in three major wars and then looks at recent conflicts. It proposes a concept for a family of new technology conventional standoff weapons. Finally, the chapter emphasizes that battles are won on drawing boards before the first blood is shed.

Chapter V describes the development of air-to-ground weapons. Our aircraft are improving, but our weapons are not. The chapter investigates the Soviet defensive SAM systems, both land- and ship-launched systems, and their capabilities. It highlights the problems of target overflight, attrition, and weapons of World War II. The chapter points out the leverage in force effectiveness to be gained from stand-off weapons. It provides information on new technology weapons in three categories, existing, near-term, and far-term.

Chapter VI addresses the potential for the future in the shifting balance of Soviet and US technology. Potential areas of involvement and US interests in each area are reviewed here. The chapter reflects the decline in the size of the strategic bomber force over the first 20 years and discusses the projected force structure to the year 2000. It evaluates the issue of autonomous versus cooperative sensors and the standoff weapon as a force multiplier. It suggests the establishment of a dedicated conventional bomber force (DCBF) of B-52Gs equipped with new technology weapons and sensors for land attack or maritime support. Detailed employment scenarios in the land attack and maritime support mission are presented to show how a DCBF could be employed. The chapter concludes that the strategic bomber, properly equipped, can be a decisive factor in future conventional conflicts.

The final chapter makes the point that a decision must be made on weapons acquisition programs and bomber force structure. New technology standoff conventional weapons could make AAA and SAM defenses a modern Maginot Line. Obstacles of parochialism, institutional resistance to change, force structure issues, funding constraints, and blending of tactical and strategic roles are impeding progress in the development of this new capability. The possibilities are economically feasible, and a DCBF would not alter our nuclear delivery capability. The decisions we make could be critical to the future security and defense of our country.



## CHAPTER I

### A CONVENTIONAL RESPONSE CAPABILITY

The primary mission of the Strategic Air Command (SAC) and its strategic bomber force is to provide a credible deterrence to nuclear war. Since 1946 when SAC was formed, these bombers, more appropriately labeled long-range combat aircraft (LRCA), have carried the bulk of the US nuclear strike capability.<sup>1</sup> The nuclear mission is still the number one priority for SAC bombers and all else remains subordinate to the successful accomplishment of that objective. However, the basic doctrine of the US Air Force says, "strategic offensive forces must be able to operate at all levels of conflict. . . . They can deliver conventional or nuclear weapons."<sup>2</sup> This requirement, to operate across the spectrum of warfare, is the primary thrust of this study. The focus will not be on a discussion of the total spectrum itself, but upon that segment that lies between the low-key political/economic options and all-out nuclear war. The middle portion of the spectrum is the area of conventional military operations.

Strategic Air Command currently has B-52s, is soon to have the B-1B, and is programmed to have the advanced technology bomber (ATB), all of which have the inherent capability to operate in the conventional role. Secretary of Defense Caspar W. Weinberger says in his Annual Report to the Congress, Fiscal Year 1984:

The inherent flexibility of manned bombers greatly increases deterrence. In addition to their nuclear capabilities, long-range bombers can be used to support general purpose force operations. They can deliver large conventional payloads to distant targets, virtually anywhere in the world. They also provide a significant increase in the firepower available to theater commanders, and are useful in naval support roles.<sup>3</sup>

Clearly, these characteristics of the LRCA (mobility, flexibility, long range and large payload) make it ideal for use in the conventional mission. But why would we need those particular characteristics to operate in the conventional spectrum of warfare? Mr. Weinberger gives us the answer.

In general terms, we need a "rapid deployment" capability primarily for those areas of the world in which the U.S. has little or no nearby military infrastructure or, in some cases, maintains no presence at all. There are many locations where we might need to project force, not only in SWA [Southwest Asia] and the Middle East, but also in Africa, Central America, South America, the Caribbean, and elsewhere.

The capability to deploy combat forces rapidly is essential to our ability to deter war and, if necessary, to fight . . . especially in the important early days of a conflict. This helps us meet our key objective of terminating hostilities at the lowest possible level of violence.<sup>4</sup>

Rapid deployment is the vital issue. It is well recognized by military planners that the first 48 to 72 hours of a conflict are potentially crucial. With minimum or no warning time, the LRCA is the only conventional military force we can project to stem the tide of the battle in those first crucial hours. Currently, the only conventional strike force dedicated to and capable of fulfilling this requirement is SAC's strategic projection force (SPF).

### The Strategic Projection Force

In 1980 Strategic Air Command developed a long-range autonomous, conventional strike force in response to the President's reaction to political turmoil in Southwest Asia. The core of this force, known as the SPF, is the B-52H. The overall force is a balanced one that includes reconnaissance, intelligence, air refueling, and force management assets. Besides the B-52H, the other (and often forgotten) aircraft tasked to support the SPF are the KC-135A and Q, SR-71, U-2, RC-135, E-3A, and EC-135. When these assets are combined, they can "operate in a stand-alone role supporting a theater commander anywhere in the world."<sup>5</sup> The SPF is a well-organized, well-trained conventional force that can be used effectively throughout the conventional spectrum of conflict. It provides our national command authorities with response options well below the nuclear threshold. Probably the most important aspect of the SPF is that it is available today and is ready for truly rapid deployment. However, a close inspection of any organization may reveal areas that could stand improvement. A look at the "saber's edge" of the SPF, the B-52H, can lead us into areas that need more investigation.

The last B-52H was delivered to Strategic Air Command in October of 1962, over 20 years ago. Even though old, this aircraft is still very capable. It has excellent range, almost 8,800 miles, unrefueled.<sup>6</sup> Each B-52H assigned to the SPF has been modified to carry 51 general purpose (GP) bombs, weapons of World War II vintage.<sup>7</sup> (See Figure 1-1.) The conventional weapons certified for carriage on the B-52H are a limiting factor on the effectiveness of the SPF. The destructive power of these general purpose bombs is inadequate for many of the targets that the SPF or any LRCA might be attacking. However, their biggest drawback is that they are gravity weapons and require target overflight for delivery. The mobility and lethality of modern defenses that are likely to be encountered today make overflight unattractive.<sup>8</sup> The adage

B-52G

B-52H

B-1B

WEAPON DESCRIPTION	ALCM MOD INTERNAL	NON ALCM			SPF		NON-SPF INTERNAL	INTERNAL*
		INTERNAL*	EXTERNAL*		INTERNAL	EXTERNAL MER		
			MER	HSAB				
750 LB CLUSTER BOMB CBU-52	27	27	24	18	27	24	27	
CBU-58	27	27	24	18	27	24	27	
CBU-71	27	27	24	18	27	24	27	
CBU-89 (GATOR)**			24	18		24		
750 LB GP BOMB M117 (LOW DRAG)	27	27	24	18	27	24	27	
M117R (HIGH DRAG)		27		18	27	24		
500 LB GP BOMB MK-82 (LOW DRAG)	27	27	24	18	27	24	27	
MK-82A/B****	27	27	24	18	27	24	27	84
MK-82SE (HIGH DRAG)	27	27	24	18	27	24	27	
MK-83 1000 LB GP BOMB (LOW DRAG)								
MK-84 2000 LB GP BOMB (LOW DRAG)	8	8		10	8		8	
CHEMICAL BOMB** MC-1 750 LB			24	18		24		
MK-94 500 LB			24	18		24		
MINES: MK-60DST 500 LB LAND/SEA	27	27	24	18	27	24	27	84
M117D 750 LB DESTRUCTOR		27	24	18	27	24		
MK-40DST 1000 LB LAND/SEA				18				
MK-52 1000 LB BOTTOM	12	12		10	12		12	
MK-55 2000 LB BOTTOM	8	8		12	8		8	
MK-56 2000 LB MAGNETIC, MOORED	8	8		12	8		8	
MK-60 2000 LB CAPTOR	8	8		10	8		8	
MK-20 500 LB ANTIARMOR*** CLUSTER BOMB			24	18		24		
				12				

\* CERTIFICATION REQUESTED - FLIGHT TESTING BEGAN MAY 1983

\*\* CERTIFICATION REQUESTED - FLIGHT TESTING TBD

\*\*\* AWAITING B-52 TECH DATA

\*\*\*\* TESTING IN PROGRESS

FIGURE 1-1 NON-NUCLEAR WEAPONS CARRIAGE

that "an aircraft is only as effective as the weapons it carries" is extremely appropriate in this case. It makes no sense to deploy or employ forces rapidly if the weapons do not destroy the target, or the delivery vehicle and crew are lost.

The finite number of our current LRCA, the B-52, and the high cost of building a B-1B make management of attrition a prime consideration in using LRCAs in a conventional role. Today's increasing defensive threat mandates the requirement to avoid direct attack, or overflight of the target area, if we are to avoid unacceptable aircraft attrition. There are few munitions currently in the inventory that will meet the requirements of this mission. New, effective, conventional standoff weapons, which should be fielded, are under development.

Is the implication being made then that the SPF is an ineffective force? Absolutely the opposite is true. It is a highly capable force, and many of the difficulties are overcome through dedicated training and innovative tactics. However, tactics and training go only so far. If we add technology, we may be able to overcome the remaining difficulties facing us in obtaining a truly effective rapid deployment capability.

#### Technological Change

This approach of favoring the improvement of our capabilities has been espoused before. General Charles A. Gabriel, Air Force Chief of Staff, stated in his September 1982 address to the Air Force Association Convention:

We depend on the high quality of our people and on superior training, tactics and technology to give us the critical edge in combat. We will hold on to this edge--just as the early air pioneers did--through the dedication of our people and through our determination to exploit technological change to its fullest.<sup>9</sup>

The exploitation of technological change can give us the desired critical edge in conventional operations. What new technology has been introduced that makes a difference? The primary breakthroughs have been in electronics, subminiaturization, new and improved gyros, improved inertial navigation systems (INS), deployment of the global positioning system (GPS), improved propulsion systems, and development of "smart" submunitions to mention only a few.<sup>10</sup> Secretary of Defense Weinberger discusses the role of new technology in our current modernization efforts:

Today, we and our allies stand at the threshold of substantial improvements in the capabilities of our conventional forces and weapon systems--if we can develop weapons that prove reliable in real world conditions, and if we can develop innovative tactics to take advantage of new or improved technology.

The various technologies have not all reached equal levels of maturity, so the actual improvement in capabilities is likely to be gradual.<sup>11</sup>

People both inside and outside of the military misunderstand technology. Technology is simply one means of achieving a practical purpose. When combined into the expression "technological change," it strikes a discordant note in the hearts of the average American taxpayer (military included). To the taxpayer technology equals expense, and to the military man (or woman) it means changes. In our country today both of these actions, spending money on defense and making changes, are resisted by many. But what do we mean by technological change? It is the end product resulting from improvements in technical processes that increase productivity of machines and eliminate manual operations or operations done by older machines.<sup>12</sup> More succinctly, it is an improved way to get things done.

The core of this study will show how technological change in weapons can enhance our conventional force projection capability and the use of our long-range combat aircraft. No matter how convincing this study may be, our acceptance and employment of new technology will come slowly. Secretary of Defense Weinberger, in a recent article on the Department of Defense's Research and Development (R&D) strength, stated:

It is characteristic of advancing technologies that the distance between fundamental scientific discoveries and their successful application may be many years. Indeed, the most advanced defense systems currently undergoing development, test or evaluation [DT&E] rest on foundations of basic scientific inquiry that originated in the 1950s and 1960s.<sup>13</sup>

Evolutionary as opposed to revolutionary is how most things happen. Two recent projects, the air-launched cruise missile (ALCM) and the B-1B, serve as good examples. The ALCM, now operational in SAC, had its origin or basic idea tested as early as 1915 by the Sperry Gyroscope Company. They used gyros to guide an aircraft or "aerial torpedo" over 100 miles.<sup>14</sup> Many years of testing and advances in technology improved upon this basic idea until this highly sophisticated, long-range, standoff weapon was deployed in 1982 as the ALCM. Only 67 years from an idea to a truly capable weapon.

The B-1B, our newest long-range combat aircraft, began its development in 1962 as the advanced manned strategic aircraft (AMSA). By incorporating 1980s technology with the earlier design (B-1A), we will have an effective strategic and conventional combat aircraft. The first actual delivery is to take place in 1986, only 24 years after its initial design. (Much of the time delay in the development of the B-1B was due to political decisions on strategic policy and economic considerations of the 1970s. Production of the B-1A had started in 1977 but was cancelled by President Carter. Technological changes incorporated in the B-1B improved upon the original B-1A.)

As these examples demonstrated, our acquisition of new weapons is, as Secretary of Defense Weinberger previously stated, "likely to be gradual." Acceptance of new ideas and concepts comes very slowly in our society. We only hope that we will not be found wanting when our "moment of truth" arrives. This "moment of truth" could come in an all-out nuclear exchange with the Soviet Union. However, if history has been any indicator and our strategic forces modernization plan is effective in maintaining nuclear deterrence, then our most likely conflict may come in the conventional arena. Here is where technology may play an important, if not decisive, role.

#### Roles and Missions for LRCA

Strategic Air Command, strategic bombers, long-range combat aircraft, ALCMs, deterrence, all have been inextricably linked to the nuclear weapons role. This is not necessarily the only area where the LRCA could be used. The potential use of these aircraft, or LRCAs, in a useful conventional mission needs to be reviewed. We might ask, how important is the conventional mission of the SAC bomber force? Will it become an increasingly important aspect of the overall SAC mission? General Bennie L. Davis, Commander in Chief, Strategic Air Command, answered both of these questions only recently.

The nature of conflict throughout the world has vividly demonstrated our requirement for the flexibility provided by a long-range bomber force especially when extended by air refueling. . . . It is a simple fact that SAC's bombers possess a combination of range, payload and day/night, all-weather responsiveness not otherwise available. . . . These capabilities make our long-range aircraft an important and unique element of our country's conventional forces. SAC's conventional role continues to expand, with forces identified to support all theater commanders, and with developing collateral roles for the B-52 such as mining and anti-shiping. The conventional capability of the Strategic Air Command has always been an important aspect of its mission; I expect it to become even more important.<sup>15</sup>

This statement on the conventional role of SAC's LRCAs is not a detractor from its primary role as a strategic nuclear deterrent. However, many initiatives are taking shape today that show the LRCA is an invaluable asset in the nuclear and conventional roles.

Already mentioned is the use of B-52s in the SPF for "rapid" conventional force projection. An equally important conventional role is the use of LRCAs to assist the US Navy in the maritime role. In late 1982, General Charles A. Gabriel, Air Force Chief of Staff, and his counterpart, Admiral James D. Watkins, Chief of Naval Operations, agreed on a memorandum of understanding (MOU) that dedicated the Air Force and Navy to closer cooperation in the maritime role. This provides the opportunity for expanding SAC's collateral mission of maritime support.

In addition to its usefulness for traditional search and surveillance and mining operations, the LRCA is also very capable in other aspects of maritime support. With the integration of a long-range standoff weapon, such as the Navy Harpoon antiship missile, the LRCA could be an invaluable asset in controlling the sea lines of communication (SLOCs). Test firings of the Harpoon from the B-52G have recently been completed with excellent results. SAC's LRCA, the B-52, should have a full operational capability (FOC) with the Harpoon very soon. This weapon is a proven, highly reliable standoff weapon that is indicative of the changing nature of warfare and weapons.

With changes in perception of aircraft employment and the introduction of improved weapons, we can see a vast potential for use of the LRCA in conventional roles and missions.

### Conventional Issues

The preceding discussion was intended to stimulate your interest in possible ways in which the LRCA, with advanced weapons, could be better used in a conventional role. During that discussion we raised several issues. A quick recap might prove helpful.

(1) The United States today must have rapid force projection to counter worldwide threats. This force must be able to operate across the spectrum of conflict in any part of the world.

(2) The increasing defensive threat poses the problem of how to cope with aircraft attrition. New technology, incorporated into new standoff conventional weapons, could provide an answer to the problem.

(3) Development of new aircraft or new weapons is an evolutionary, not a revolutionary, process in the United States.

(4) The long-range bombers of Strategic Air Command will play an important role in future conventional operations.

These issues are only a few that arise when discussing strategic bombers or LRCAs in a conventional role.

When discussing the development of new conventional weapons, even in the Air Force, we meet with some very lively debate. Often the arguments against new developments and changing roles stem from an emotional rather than a factual basis. However, the annual battle of the budget cycle and limited financial resources for defense spending inevitably raise the specter of parochial interests. If we are to make any progress in combating the threats to our security, these parochialisms must be set aside. A combined effort toward one common goal is essential not only between commands in the Air Force but also among all military services. Only then will we be able to determine the forces and weapons that can best do the job.

The LRCA and advanced conventional standoff weapons are not proposed as the panacea, or in military jargon the "silver bullet," for all contingencies. If these conventional capabilities were developed, they would allow us the flexibility to plan for worldwide contingencies. The flexibility that evolves from these new weapons could be instrumental in determining an appropriate response to threats across the spectrum of conflict. A strong, effective, conventional capability and the continuance of a nuclear umbrella can strengthen our deterrent and war-fighting options.

### Purpose of Study

This study is devoted to the postulate that with the proper combination of technology in advanced conventional standoff weapons and strategic bombers, the Air Force can provide a credible deterrent force for use across the conflict spectrum and provide the national command authorities with a complete range of response options to any crisis.

### Organization of Study

This study was written with the hope of reaching as large an audience as possible. In attempting to accomplish that task, the entire study was completed at the unclassified level of information.

Because of the wide range of backgrounds and varying levels of knowledge that each reader may have on new technology conventional weapons and strategic bombers, this study covers a broad range of topics on different levels of expertise.

The individual who is not fully knowledgeable about the historical use of strategic bombers or not up to speed on current strategic force modernization efforts should read Chapters II and III for background information.

The professional Air Force officer, and those more technically oriented, may wish to bypass Chapters II and III and proceed to Chapter IV, "Attrition and Technology," where the difficulties in fighting a conventional war in today's high-technology environment are introduced.

### Scope of Study

Why undertake this study? Colonel T. N. Dupuy, USA (Retired), in his book The Evolution of Weapons and Warfare explains very well:

Basic research in the related processes of the invention of weapons, their adoption, and their assimilation through changes in tactics, organization, and doctrine, is badly needed. . . . Case



histories in scholarly monograph form of significant tactical innovations and increases in lethality of weapons would provide material for analysis in depth and later recommendations in regard to U.S. policies and institutions.<sup>16</sup>

The intent of this study is to achieve the objectives outlined by Colonel Dupuy. All material here is unclassified. A large amount of research material has been condensed in this study, but the essence of the message is maintained throughout the distillation process.

This study addresses current and planned conventional weapons and strategic aircraft development from 1983 to the late 1990s. To project beyond the turn of the century would be speculation and has purposely been avoided. Many excellent studies by large organizations and by the Air Force bring numerous and varied disciplines to bear on the many facets of these issues.<sup>17</sup>

To insure no misunderstanding on your part, a few definitions are necessary.

Conventional weapon. This is any weapon that does not use nuclear materials as a source to create a destructive force. (Weapons could use depleted uranium or other "heavy" materials as a kinetic energy penetrator.) Only those conventional weapons that are delivered air-to-ground will be discussed.

Advanced standoff weapon. Simply stated, this is any air-to-ground weapon that can be launched outside the lethal range of defenses surrounding the target being attacked. The range requirement would vary, depending upon the type of defensive systems encountered. These standoff weapons could form a "family of weapons" with ranges from a few miles out to hundreds of miles.

Long-range combat aircraft (LRCA). For an aircraft to be a LRCA it

must be able to fly long distances, to carry large, diversified weapons loads, to provide self-contained capability for target acquisition and weapons delivery [unless used in conjunction with an external targeting system] . . . and, most importantly to provide on-scene human judgment throughout the mission.<sup>18</sup>

Figure 1-2 provides examples of past and current LRCA information. (For the remainder of this study, the B-52, B-1B, and ATB will be considered LRCAs.) Technology was defined earlier in the introduction and will not be repeated here. Other definitions will be provided in the text when required for clarity.

George Santayana is credited with the saying, "Those who cannot remember the past are condemned to repeat it." Our previous use of LRCAs in combat, the weapons, and the corresponding strategy and tactics

FIGURE 1-2. LONG-RANGE COMBAT AIRCRAFT

	Maximum Range (Unrefueled)	Maximum Weapons Wt	Maximum Gross Wt	Speed @ 500 MSL
Long Range:				
B-36H	8,800 NM	84,000	358,000	High Altitude
B52C-F	5,300 NM	60,000	450,000	390 KTS
B-52G	6,500 NM	70,000	488,000	390 KTS
B-52H	8,800 NM	70,000	488,000	390 KTS
B-70	6,160 NM	Developmental	530,000	High Altitude
B-1B**	6,475 NM	64,000	477,000	521 KTS
ATB***	?	?	?	?

\* The Figures specified vary according to source, model, and series.

\*\* B-1B "typical conventional weapon load."

\*\*\* Advanced Technology Bomber (ATB) characteristics unknown.

should provide a foundation on which to base the remainder of this study as we deal with new technology conventional weapons and their employment on SAC's long-range combat aircraft. We can no longer afford to use the LRCA, a precious Air Force asset, in conventional combat in the same way as we have in the past.

## NOTES

### CHAPTER I

1. For an excellent historical reference on Strategic Air Command, see The Development of Strategic Air Command 1946-1981 (A Chronological History), 1 July 1982, Office of the Historian, Headquarters Strategic Air Command, Offutt AFB, Nebr.

2. AFM 1-1, Functions and Basic Doctrine of the United States Air Force (Washington, D.C.: Department of the Air Force, 1979), chap. 2, p. 8.

3. Caspar W. Weinberger, Annual Report to the Congress, Fiscal Year 1984 (Washington, D.C.: US Government Printing Office, 1983), p. 223.

4. Ibid., p. 191.

5. USAF Fact Sheet 81-038, Headquarters SAC, Office of Public Affairs, "SAC's Strategic Projection Force (SPF)," December 1981, Offutt AFB, Nebr.

6. Director of Cost and Management Analysis, SAC Facts Book (Offutt AFB, Nebr.: Strategic Air Command, 1982), p. 18.

7. Strategic Air Command, Avionics Division, "Non-Nuclear Weapons Carriage," extracted from a chart developed by the Avionics Division to show status of conventional weapons efforts on SAC bombers, dated 15 April 1983.

8. Report of the USAF Scientific Advisory Board Ad Hoc Committee on "Non-Nuclear Armament," Summer Study, 22 June-2 July 1981, Executive Summary, vol. I (Secret), Headquarters USAF, Scientific Advisory Board, p. 3. (Referenced statement is unclassified.)

9. General Charles A. Gabriel, USAF, "From Silk Scarf to Spacecraft," Air Force Magazine, 65, no. 11 (November 1982):80.

10. For a clearly superior perspective of all aspects of technology enhancements, see the entire issue of the IEEE Spectrum, "Technology in War and Peace," October 1982. Also has an excellent bibliography for further research.

11. Weinberger, p. 47.

12. Webster's New Collegiate Dictionary (Springfield, Mass.: G & C Merriam Company, 1977), p. 1197.

13. Caspar W. Weinberger, "The R&D Key," Defense 83 (Washington, D.C.: US Government Printing Office, 1983), p. 2.

14. Kenneth P. Werrell, "The Cruise Missile: Yesterday, Today, and Tomorrow," (Research report, Airpower Research Institute, Maxwell AFB, Ala., 1983), chap. II, p. 8. (Unpublished)

15. General Bennie L. Davis, USAF, "General Davis Leads Key Strategic Forces," an interview with USA Today, 17 March 1983, p. 5c.

16. Colonel T. N. Dupuy, USA (Retired), The Evolution of Weapons and Warfare (Indianapolis/New York: Bobbs-Merrill Company, Inc., 1980), p. 342.

17. The previously cited IEEE Spectrum issue of October 1982 and a classified study by the Air Force entitled Air Force 2000 (Secret), Headquarters USAF Deputy Chief of Staff Plans and Operations, are both excellent documents for further investigation on technology requirements in the 21st century.

18. Lieutenant General Kelly H. Burke, USAF (Retired), "The Strategic Triad in the '80s," Supplement to the Air Force Policy Letter for Commanders, April 1980, p. 28.

## CHAPTER II

### A HISTORICAL PERSPECTIVE

To put advanced technology and the spectrum of conflict in perspective, first we need to establish the historical context from which to depart. Colonel Thomas A. Fabyanic, USAF (Retired), creator of the Fabyanic model for strategy analysis, expands upon this perspective of the historical review:

A sense of history is an essential element in the strategic thought environment for several reasons. First, it prevents one from viewing war in a vacuum or isolation, by demonstrating the relationship between war and those political, economic, social and intellectual considerations that permit war, condition its execution and affect its outcome. Second, history strengthens critical judgment by forcing one to recognize that objective evidence, regardless of its relevance, and rational behavior, despite its intellectual appeal, represents only a part of the process of evaluating conflict.<sup>1</sup>

In developing new strategies, emotions should not play a dominant role. However, as Noble Frankland stated in his 1963 Lees Knowles lectures at Trinity College, "people have preferred to feel rather than know about strategic bombing."<sup>2</sup> The intent here is to minimize that emotion and to review the strategy and weapons that have been developed for the manned bomber in past wars and trace that strategy and weapon relationship to present strategies.

There are many articles and books on the effectiveness of past strategies of strategic bomber employment. No attempt to argue this point will be made here. Instead, the historical problem of translating strategy into employment concepts and their associated weapon systems will be investigated. The linkage between strategy and weapons is of major importance to military planners.

#### The Doctrine Formulation Period 1930-1941

When war came to the United States on 7 December 1941, the doctrine of strategic air attack was already firmly established. During the period of 1920 to 1940, the US military planners had formulated a doctrine based on a premise that neutralization of an enemy nation's industrial base would destroy the will and means of the enemy to wage war. It is important to understand this World War II baseline, for many of these same principles are applicable and used today.

The Air Corps Tactical School was the focal point for the development of strategic bombardment doctrine during the period of 1920 to 1940. The school was founded in 1920 under the title of Air Service

Field Officer's School. After a change in name, a move, and a change in scope of the course, it became the Air Corps Tactical School at Maxwell Field, Alabama (1931). In the classroom sat Ira C. Eaker, Carl Spaatz, Curtis E. LeMay, Haywood S. Hansell, and Claire E. Chennault. These men would later become central figures in the development and employment of strategic bombardment doctrine.

The school went through many steps in the development of a strategic bombardment doctrine. The doctrinal work was heavily influenced by the experience of World War I and by the very vocal advocate of airpower, General "Billy" Mitchell. By 1930 the school's central theory of strategic bombardment included one premise that was to last throughout most of the war. Specifically the premise was that bomber formations could, within themselves, provide sufficient self-defense against hostile aircraft.

Let it be assumed that a defensive formation of bombardment airplanes properly flown, can accomplish its mission unsupported by friendly pursuit when opposed by no more than twice its number of hostile pursuit. . . . When aggressively attacked by hostile pursuit, there will be losses on both sides, and the mission will lose some of its effectiveness. No measure of loss in airplanes or effectiveness can be assumed, but it will be assumed that the mission will be accomplished.<sup>3</sup>

The school's theory did, however, have an escape clause in that it did address the situation when superior defenses (high-performance fighters in large numbers) attacked the bomber formation. The 1935 Bombardment Text stated:

In this situation the pursuit opposition is assumed to possess an overwhelming superiority in all factors influencing air combat . . . escorting fighters will neither be provided nor requested unless experience proves that bombardment is unable to penetrate such resistance alone.<sup>4</sup>

The other parts of theory developed during the 1930s by the Air Corps Tactical School included the following:<sup>5</sup>

(1) Accurate strategic bombing favored daylight operations. Daylight would improve bombing accuracy because it would allow large aircraft formations and would reduce the navigation problem.

(2) Attacks should be from high altitude. Low altitude, treetop-level bombing was considered as a means to reduce detection by hostile aircraft but was rejected because of navigation problems.

(3) Attacks should be against the national economic structure to reduce the will and ability of the enemy to fight. The targets included:

- refineries
- electric power
- aircraft industrial facilities
- steel industry
- transportation systems
- raw materials

The aim of the strategic bombardment doctrine developed by the tactical school was not complete destruction of the above listed targets. Instead, the goal was to disorganize the enemy's war-making industrial base.

It must be remembered that disorganization . . . rather than complete destruction, is the ultimate aim of the Air Force. . . . Disorganization . . . is the aim because it is more economical and is equally effective.<sup>6</sup>

The tactical school also developed a probability concept to determine how many bombs would be required to destroy these targets. The school used a 90 percent probability of destruction for the targets selected and used peacetime results of bombing competition. This information was vital because it was used to determine the force composition required to destroy the selected targets. But use of the concept did have its limitations, since it assumed that each bomb would be individually aimed and that peacetime bombing accuracy would be the same as combat experience. The actual combat experiences altered these major assumptions and changes had to be made. But the concept set the stage for the use of probability in military situations and did highlight the need for precision strikes.<sup>7</sup>

### World War II

In July 1941 President Franklin D. Roosevelt expressed concern that our doctrine and weapons available might be mismatched in a potential conflict. He directed Secretary of War Henry Stimson to determine the overall production requirements needed to defeat our potential enemies.<sup>8</sup> Building upon the personnel of the Air Corps Tactical School and doctrine of the Bombardment Text, the War Department produced the Air War Plans Division (AWPD) document that became known as AWPD-1.

Developing the plan (AWPD-1) was a massive undertaking. An overall time period had to be set up, targets selected, accuracy of weapons determined, bomb requirements established, and finally aircraft loss rates computed. The basic approach to the problem of the Air Corps Tactical School was used; however, the combat experience of our Allies



altered some of the specifics of the school's doctrine. The following are the results of the planners' work for the AWPDP-1.<sup>9</sup>

(1) Time period. July 1943--start of operations. Final all-out attack during the period of April to September 1944.

(2) Targets included 154 separate sites. Included were electric power systems, transportation, petroleum (124 of 154), aircraft assembly plants, aluminum factories, and magnesium plants. Electric power was the primary target.

(3) Planners established that 220 bombs would be necessary to destroy a 100 square-foot target.

(4) A heavy bombardment group would include 70 aircraft. Royal Air Force (RAF) bombing errors during the war were 2.25 times greater than peacetime bombing, so 30 groups were necessary to destroy a target. When applied to all targets using only eight suitable weather days per month for daylight visual bombing in a six-month period, 6,860 bombers were determined necessary for the bombing effort.

Besides the determination of the force required, the air planners went one step further with AWPDP-1. The planners enthusiastically stated that if the air offensive was successful, land invasion may not be necessary.<sup>10</sup> The bold air plan was submitted to Army Chief of Staff General George C. Marshall. He quickly approved and forwarded the plan to the President who also approved its implementation.

In late 1942, based on wartime experience, AWPDP-1 was updated and called AWPDP-42. It was similar to the previous plan in that airpower was the key to operations against Germany. It called for a conclusive strategic offensive against the Axis powers and for a strategic defensive against Japan in the Far East. The differences in the two plans were that AWPDP-42 included combined Army Air Forces (AAF) and RAF operations along with a much broader target system. The following excerpt from AWPDP-42 shows this combined AAF and RAF offensive strategy:

The air offensive against Germany is a combined effort by the U.S. Army Air Force and R.A.F. The U.S. Army Air Force will concentrate its efforts upon systematic destruction of selected vital elements of the German military and industrial machine through precision bombing in daylight. The R.A.F. will concentrate upon mass air attacks of industrial areas at night, to break down morale.<sup>11</sup>

The target list specified in AWPDP-42 was broader in scope than AWPDP-1. More emphasis was placed on destruction of the German U-boat threat and the Luftwaffe. The targets in priority order included:<sup>12</sup>

<u>Target</u>	<u>Number of Targets</u>
Pursuit airplane	11
Assembly plants	
Bomber airplane	15
Assembly plants	
Aeroengine plants	17
Submarine yards	20
Transportation	38
Power	37
Oil	23
Aluminum	14
Rubber	<u>2</u>
Total targets	177

With the new target system the AWPD-42 also revised the force structure required. The requirement for bombers was established at 2,965. Additionally, in contrast to AWPD-1 the plan called for fighter escort. (This is perhaps one of the major differences between the doctrine developed by the Air Corps Tactical School in peacetime and the requirements generated as a result of war experiences.) The planners used a bombing accuracy of 1,000 feet for circular error probable (CEP) in determining force requirements. In reality the CEP was approximately 2,000 feet. This optimism led the planners to state that for the 177 targets, the requirement was 136,500 tons of bombs for 66,045 sorties by 2,965 heavy bombers.<sup>13</sup>

In November 1942 the Casablanca Conference changed much of the specific plan for strategic bombing developed by AWPD-1 and AWPD-42. President Franklin D. Roosevelt and Prime Minister Winston L. Churchill blended the strategic bombing offensive into their overall plan for the war. This was done because the forces required by the AWPD-42 were not yet available, the results of British and US bombing to date were somewhat disappointing, and the belief by the Combined Chiefs of Staff that both land and air operations were necessary.<sup>14</sup> The Casablanca Conference established that the overall goal of the air offensive was the progressive destruction and dislocation of the German military, industrial, and economic system and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened.<sup>15</sup>

The conference also directed the following target system in order of priority:<sup>16</sup>

- (1) German submarine construction yards
- (2) The German aircraft industry
- (3) Transportation
- (4) Oil plants
- (5) Other targets in enemy war industry

The Casablanca agreements on target priority were not the ultimate conclusion of what targets, how many aircraft, and what accuracy of weapons should be used in planning for the strategic bombing offensive. A Committee of Operational Analysts (COA) made a study of the German economy and, based on the strategy outlined at the Casablanca Conference, made yet another target list recommendation.<sup>17</sup> This list was combined with the option military planners developed under AWPD-42, and the COA developed a list for the combined bomber offensive (CBO). Targets were in order of priority:

- (1) Intermediate objective
  - German fighter strength
- (2) Primary objectives
  - German submarine yards and bases
  - The remainder of the German aircraft industry
  - Ball bearings
  - Oil
- (3) Secondary objectives in order of priority
  - Synthetic rubber and tires
  - Military motor transport vehicles<sup>18</sup>

This target list equated to 76 actual targets with a force requirement of 2,702 bombers. This force was never fully delivered to the field and as a result the Eighth Air Force fell short in destroying all targets on the CBO list. While the bombers were attacking German facilities, the long-range fighter escorts were destroying the German Luftwaffe in the air. By March 1944 the Luftwaffe was no longer able to sustain counterattack.<sup>19</sup>

The impact of the Casablanca Conference on the target priority of the European war indicates the high levels of involvement by Allied leadership in strategy development. The President of the United States was deeply involved in all matters of strategic importance. President Roosevelt preferred the title of Commander in Chief instead of President. The strategy he approved as Commander in Chief reflected a total commitment to victory and was only minimally influenced by domestic matters or even by the Secretary of State.<sup>20</sup> This precedence of political influence on strategy is important and is still relevant in the discussion of strategy and the development and use of strategic weapons in the 1970s and 1980s.

The significance of the strategic bombing attacks on the industrial base of Germany was reflected by Albert Speer who commented 30 years after the attack.

I shall never forget the date May 12 [1944]. . . . On that day the technological war was decided. Until then we had managed to produce approximately as many weapons as the armed forces needed, in spite of their considerable losses. But with the attack of nine hundred and thirty-five daylight bombers of the American Eighth Air Force upon several fuel plants in central and eastern Germany, a new era in the air war began. It meant the end of German armaments production.<sup>21</sup>

The overall lessons of the strategic bombing war were reflected in the report by the United States Strategic Bombing Survey (USSBS). The report made these general observations:

full scale strategic bombing directed at the heartland of any major power, even one as rugged and resilient as Germany's, could be decisive. . . . Regardless of the forces actually applied, the USSBS concluded that persistent re-attack of all targets was necessary since no target system had been put out of commission by a single attack. With regard to morale, which was not broken, the USSBS concluded that the power of a police state over its people cannot be underestimated.<sup>22</sup>

#### The Strategic War in Japan

By the time the war effort moved to the Pacific, the doctrine and the associated weapons were more refined. The US strategic air war in Europe was fought primarily with the B-17, whereas the strategic air war against Japan used the more modern and capable B-29. The USSBS addressed even more comparisons of the European and Pacific wars.

The physical destruction resulting from the air attack on Japan approximates that suffered by Germany, even though the tonnage of bombs dropped was far smaller. The attack was more concentrated in time, and the target areas were smaller and more vulnerable. Not

only were the Japanese defenses overwhelmed, but Japan's will and capacity for reconstruction, dispersal and passive defenses were less than Germany's. In the aggregate some 40 percent of the built-up area of the 66 cities attacked was destroyed. Approximately 30 percent of the active urban population of Japan lost their homes and many of their possessions. The physical destruction of industrial plants subjected to high-explosive attacks was similarly impressive. The larger bomb loads of the B-29 permitted higher density bombs per acre in the plant area, and on the average, somewhat heavier bombs were used. The destruction was generally more complete than in Germany. Plants specifically attacked with high-explosive bombs were, however, limited in number.<sup>23</sup>

Perhaps the theory of strategic air attack to reduce the will of the enemy was best exemplified by the incendiary raids on Japan. Civilian deaths attributed to these incendiary raids were staggering. It was reported that

【civilian deaths】 exceeded the number of strictly military deaths inflicted on the Japanese in combat by armed forces of the U.S. . . . more persons were killed in one 6-hour period by the least expenditure of bombs than in any other recorded attack of any kind.<sup>24</sup>

The targets struck by the B-29s in Japan were similar to those in Europe. Apparently there was not the lengthy problem of determining target priority. The Joint Chiefs of Staff priority targets were engine manufacturing plants, followed by four aircraft component and assembly plants. Port and urban industrial areas were designated as secondary targets. The Joint Targeting Group in Washington stated:

there were no strategic bottlenecks in the Japanese industrial and economic system except aircraft engine plants, but . . . the enemy's industry as a whole was vulnerable through incendiary attacks on the principal urban areas.<sup>25</sup>

The use of low-level night attacks was implemented as a new tactic and was executed effectively by Major General Curtis LeMay's B-29 force. This tactic reduced fuel consumption by eliminating climbs to 30,000 feet and allowed increased bomb loads.<sup>26</sup>

Another use of the strategic bomber frequently overlooked in a discussion of the strategic air battle is the mission of aerial minelaying. The average B-29 during a minelaying sortie flew 2,900 NM and carried 12,000 pounds of mines. From April to August 1944, B-29s flew 1,500 sorties, delivered 12,000 mines, and sunk over 760,000 tons of Japanese shipping.<sup>27</sup> This capability contributed directly to the deterioration of the Japanese economic base by denying the raw materials required for production.

## World War II Weapon Systems

The main weapon system for the daylight bombing offensive against Germany was the B-17 Flying Fortress. Initially the bomber did not live up to its name of Flying Fortress because it was underpowered and underarmed. By the end of 1941 the B-17E was much improved in both engine horsepower and armament. The B-17G was improved even more and had a top speed of 300 mph at 30,000 feet, an armament of 13 .50-caliber machine guns and carried up to 17,600 pounds of gravity weapons for short ranges or 4,000 pounds for long ranges.<sup>28</sup>

The Boeing B-29 Superfortress was a clear example of strategy, wartime experience, and operational need leading to a weapon system. The request for design of a superbomber to replace the B-17 and B-24 was let in December 1939. The design of this aircraft reflected the doctrine of high-altitude bombing by a heavily armed bomber. The armament of the B-29 included four remote-controlled turrets each containing two .50-caliber machine guns and a direct-controlled tail turret containing two .50-caliber machine guns and a 20 mm cannon. It could carry up to 16,000 pounds of bombs with a maximum range of 5,830 miles. Specific carriage included:<sup>29</sup>

4 - 4,000 lb bombs, or

8 - 2,000 lb bombs, or

12 - 1,000 lb bombs, or

40 - 300 lb bombs, or

80 - 100 lb bombs

Another technological innovation that began to prove worthwhile was the incorporation of radar (APQ-13 or APQ-7) in the B-29. During the European strategic offensive, daylight precision bombing required clear weather and good visibility for the Norden optical bombsight to work. In the Pacific theater, improvements in radar allowed strategic precision bombing to be expanded to nighttime and in all-weather conditions. General LeMay sent the following message after he had reviewed the results of the radar-directed bombing:

Successful strike is subject. I have just reviewed the post-strike photography of your strike on target 1764, the Maruzen Oil Refinery at Shimotsu, the night of 6/7 July. With a half-wing effort you achieved ninety-five percent destruction, definitely establishing the ability of your crews with the APQ-7 to hit and destroy precision targets, operating individually at night. The performance is the most successful radar bombing of the command to date.<sup>30</sup>

The addition of radar truly complemented the B-29 as a precise strategic bomber.

As previously outlined, another modification of the European strategy in the Pacific theater was the switch to nighttime incendiary bombing attacks. The low-level attacks using incendiary weapons complemented the already versatile B-29 strategic bomber. Another tactic to multiply the effectiveness of the B-29 was the removal of all guns from the heavily armed B-29. This allowed more incendiary weapons to be carried, improving effectiveness. All gunners except the tail gunners stayed on the ground.<sup>31</sup>

A weapon system that did not see combat but was the result of the war was the Convair B-36. The contract for development of the B-36 was let on 15 November 1941. The requirement was for a bomber that could fly 10,000 miles and could carry five tons of bombs or 36 tons of bombs at lesser ranges.<sup>32</sup> (B-36A could carry 72,000 pounds; B-36B, 86,000 pounds; B-36J-5, 43,000 pounds.)<sup>33</sup> The design of this system began because it seemed likely that England might fall, in which case a bomber would be required to fly from the United States to Germany and return. The B-36 was the largest bomber ever built and was test flown on 8 August 1946.<sup>34</sup> Delivery was made to Strategic Air Command in 1948 and was fully operational in 1951.<sup>35</sup>

World War II did see some revolutionary ideas in exploring weapons. A cruise missile type effort was attempted by using the "war-weary" B-17s. The bombers were stripped of armament and nonessential flight equipment and were loaded with 18,500 pounds of explosives. After the pilot got the plane off the ground and after the technician adjusted the equipment, both would bail out over England.<sup>36</sup> The results were not spectacular, but it did show an early interest in a standoff concept.

### Nuclear Weapons

The atomic bomb attacks on Hiroshima and Nagasaki are perhaps the most publicized of the strategic bombing attacks of the war. From a strategy to weapon standpoint, they were a logical development of the doctrine of massive air attack. From a historical standpoint, the atomic weapons caused a long hiatus in US strategic planning and development of new conventional weapons.

Whether the atomic explosions alone contributed to the surrender of Japan has been much discussed. The USSBS concluded:

From the standpoint of the politics of surrender--and by August 1945 politics was the key--the atom bombing of Hiroshima and Nagasaki was not essential. From its studies of Japanese resources, military position, and ruling class politics, the survey estimates that the government would have surrendered prior to 1 November and certainly before the end of the year, whether or not the atomic bombs had been dropped and Russia had entered the war. In the 10 to

15 weeks between the actual and probable surrender date, the air attack from the Marianas, augmented by the Okinawa-based forces, would have reached a new high. Furthermore, morale probably would have continued its already steep decline to complete demoralization. The atom bombs hastened surrender, but did not themselves provide the major motive.<sup>37</sup>

The atomic weapons did, however, contribute to the establishment of a deterrent strategy that prevails even today. This strategy clouded the proper employment of the strategic bomber in Korea.

#### Korean War 1950-1953

The results of the strategic bombing campaign against North Korea can be classified as successful but somewhat confusing. The strategic bomber campaign in Korea lasted only eight weeks. Strategic operations began in August of 1950 and were terminated on 27 September 1950 by the Joint Chiefs of Staff. It was determined

that destruction of such targets of relatively long-term military significance was no longer considered necessary. Hence forward, all air operations were to be directed against objectives which had an immediate bearing upon the tactical situation in Korea.<sup>38</sup>

Contributing to this change of strategy was the political influence. The military planners compiled a priority listing of strategic targets. These targets were assigned by area rather than specific target system. Most of the priority targets were close together and would require a minimum number of raids. The SAC plan called for incendiary raids against the target areas followed by demolition bombs in precision attacks against the industrial plants.<sup>39</sup> The plan was approved by the military structure, but

Washington was very hesitant about any air action which might be exploited by Communist propaganda and desired no unnecessary civilian casualties which might result from fire raids. . . . A little later the Joint Chiefs of Staff forwarded further instruction that bomber commands must drop warning leaflets notifying civilians to leave the industrial areas before the factories were attacked.<sup>40</sup>

Clearly this use of the strategic bomber had come a long way from the fire bombings of Japan and the strategy used in Europe. The cold war with the Soviets had impacted the hot war in Korea. Thus the political situation determined the use of the strategic bomber.

Briefly the role of the strategic bomber in Korea highlighted several considerations. These were:

(1) The strategic bomber could be used in limited war to strike strategic targets; however, many targets may be off limits to the bomber because of political constraints.



(2) Strategic bombers could also be used in the interdiction role, and this in fact could become a primary role.

(3) Strategic bombing does not necessarily include destroying the will of the enemy to fight by destroying population centers.

(4) Precision bombing would be required.

(5) Target selection would be controlled by the political process.

(6) Nuclear weapons do not necessarily prevent war at lower levels of conflict.

But the emphasis was still on nuclear weapons. Little effort was placed on improving conventional munitions. The following statement of the 1953 National Security Council resolution 162/2 set the stage for the strategy of massive retaliation. ". . . air power and nuclear weapons should provide the nation primary means of defense--plans should be developed to use nuclear weapons whenever desirable militarily."<sup>41</sup>

#### The Strategy of Massive Retaliation and Assured Destruction 1953-1965

In World War II we had a strategy and then developed the bomber weapon system to carry it out. In Korea political constraints reduced the effectiveness of bombers in their strategic role and instead used them primarily in an interdiction role. With the strategy of massive retaliation, we tried to change the limitations imposed by the cold war conflict by reducing war to nuclear terms only. We hoped to prohibit war at all levels. The realities of Korea and the result of strategic bombing in World War II seemed to be forgotten in the belief that nuclear weapons would deter all war. The confusion on the role of strategic bombers in Korea led Secretary of State John Foster Dulles in January 1954 to state that the strategy of the United States would depend primarily upon a great capacity to retaliate, instantly, by means and at places of our choosing.<sup>42</sup> Air Force doctrine reflected this same theory of massive retaliation. AFM 1-8, Strategic Air Operations (1 May 1954) stated:

At the outset of war the destructive capacity of modern strategic air weapons is such that virtually the whole of the enemy's economic, political, military, and urban social structure can successfully be brought under attack. While the nature of these weapons systems render them nonselective relative to small targets within a large area, their inherent characteristics permit destruction or neutralization of the entire complex of industrial production, government, military, and economic control, and communication by attacks or relatively few aiming points. . . . The greatest urban complexes in the world are subject to complete and immediate annihilation when certain weapons are applied.<sup>43</sup>

The doctrine of massive retaliation reflected many of the same premises of the AWPD-1/42; however, this time it was based on nuclear weapons.

During the period of massive retaliation both the United States and the Soviet Union made significant strides in the accuracy and types of nuclear weapons. The United States was unable to monopolize the weapons of massive retaliation. These crucial realities were slow to be accepted as the official position, and in 1959 the Secretary of Defense reported "that our ability to launch a massive retaliatory strike against any aggressor continued to be effectively maintained."<sup>44</sup>

The force structure at the beginning of 1960 reflected this same belief; it was a strategic bomber nuclear force.<sup>45</sup> The mid-1960s effort was directed at securing a 30 percent nuclear alert for the B-52 force, improving the penetration capability of the bomber by using low-altitude penetration tactics, Hound Dog standoff missiles, improved electronic countermeasures (ECM), and Quail missiles (B-52 decoy missile).<sup>46</sup>

With a change of administration from Eisenhower to Kennedy and the realization that the strategy of massive retaliation had not deterred the Soviets, a new strategy was developed.

The nuclear strategy of assured destruction began the shift away from massive retaliation. In 1965 Secretary of Defense Robert S. McNamara defined assured destruction as the ability to

deter deliberate nuclear attacks upon the United States and its allies by maintaining a highly reliable ability to inflict an unacceptable degree of damage upon any single aggressor, or combination of aggressors, even after absorbing a surprise first strike.<sup>47</sup>

The definition McNamara used for unacceptable damage was "one-quarter to one-third of its population and about two thirds of its industrial capacity."<sup>48</sup>

The nuclear strategy of assured destruction differed from the previous strategy in two important ways. First, because nuclear weapons were more effective, the targeting system was revised. Second, this strategy allowed for the incorporation of the theory of flexible response. Massive retaliation by definition would not allow this to happen. As early as July 1950, Eugene Rabinowitz wrote in the Bulletin of Atomic Scientists:

If we concentrate on fabrication of weapons of mass destruction, and do not balance this development by the creation of sufficiently large, well-supplied, and strategically distributed land forces, we will run a double danger: We will be in danger of losing out in peripheral skirmishes with Soviet satellites, such as the Korean war; and we will deprive ourselves of freedom of decision in the event of an open Soviet aggression against nations of the Atlantic Pact. If we have nothing but atomic bombs with which to strike

back, we will obviously be forced to use these weapons--even if the enemy does not do so first, and even if our leaders have grave doubts about the political wisdom and moral justification of their use.<sup>49</sup>

The Cuban missile crisis of 1962 is an excellent example of the need for nonnuclear alternatives under the nuclear umbrella. Flexible response did allow a greater emphasis on conventional forces. But, as events later showed, it was secondary to nuclear weapons requirements and political constraints.

The first change noted under assured destruction was the targeting system. The targets proposed by McNamara would avoid urban area destruction.

[The United States] has come to the conclusion that to the extent feasible, basic military (targeting) strategy in a general nuclear war should be approached in much the same way that more conventional military operations have been regarded in the past. That is to say, principal military objectives, in the event of a nuclear war stemming from major attack on the Alliance, should be the destruction of the enemy's military forces, not of its civilian population.<sup>50</sup>

This targeting system seemed to be based on the same thought process that had been used to avoid the population centers in the strategic bombing attacks in Korea. This methodology of going after principal military objectives was to influence the practice of flexible response in Vietnam. The strategy of avoiding urban centers as targets, however, did not last. In 1965 Secretary of Defense McNamara articulated his assured destruction strategy with emphasis on countervalue instead of the counterforce target concept expressed in 1962.<sup>51</sup> The reason for this change is not totally clear, but may have been the result of the realization of the limitations of the ICBM to accurately destroy the military targets. The Air Force doctrine published in 1965 allowed for both military (counterforce) and urban centers (countervalue). The doctrine stated that the force possessed the capability to selectively destroy the whole or any part of a hostile nation's structure.<sup>52</sup>

One of the outcomes of this doctrine was the founding of the Joint Strategic Target Planning Staff (JSTPS) and the establishment of a comprehensive nuclear strike plan known as the single integrated operational plan (SIOP). The JSTPS established target priorities in combination with forces capability and doctrine tied to maintain deterrence with the nuclear umbrella.

The nuclear concepts that the JSTPS worked with throughout the 1960s and 1970s changed. After assured destruction, the concept of realistic deterrence followed. After SALT I in 1972 strategic sufficiency was the concept followed; then this concept was followed by

essential equivalence. All were based on the premise that nuclear war was too unthinkable to occur.

The strategy of flexible response was developed with the realization that all levels of war would not be deterred by nuclear weapons. The priority that the conventional weapons for strategic bombing would have in relation to nuclear weapons was clear. This was shown very clearly in the DoD decision to reduce the number and types of manned bombers in a SAC Hearing before the House Committee on Armed Services in 1966. The following excerpts are from that hearing:

Mr Handy. Mr Chairman, thank you. I would like to get a definition, so we can all understand what we mean when we talk about a strategic bomber. . . . General McConnell [Chief of Staff, USAF]--a strategic bomber--the original concept--and I think this concept still holds--is one which was built for the purpose of destroying fixed targets in an enemy territory--and normally operating bases far removed from the enemy's homeland so it could not be easily attacked. . . . It must have long-range, and it should have as high a speed as it is economical to operate and be within a state of the art, which is something below--which is about 2.5. . . . You want a long-range large payload. You want to be able to handle either nuclear or nonnuclear weapons. Mr Handy. What is the size of the payload which is required for a bomber to be truly a strategic bomber?

General McConnell. With a nuclear weapon, we will confine ourselves to nuclear weapons, I think, that will be better for the time being.

Mr Hardy. If you are going to confine use to nuclear weapons, then we have decided what kind of warfare we are going to fight.

General McConnell. I was going to answer your question first about a nuclear weapon, Mr. Hardy. A [deleted] payload with nuclear weapons is ample for a strategic bomber to do a considerable amount of damage.

When you get to conventional payloads, until such time as we have developed more sophisticated conventional weapons, which of course we are always in the process of doing, it should be able to carry about. . . .

Mr Handy. Is the B-58 a strategic bomber?

General McConnell. Yes, sir, it is a strategic bomber. . . . It fits the definition, with the exception of capability to carry conventional weapons. . . . At the time the B-58 was built we weren't thinking about using conventional weapons, therefore, it had no conventional weapon capability. . . .<sup>53</sup>

During further discussion General McConnell stated, "I would rather sacrifice the conventional role to get a better capability in the nuclear role."<sup>54</sup> The nuclear weapon was the point of primary design for any new strategic bomber. Conventional capability was then, as it is today, a secondary consideration. Assured destruction was still the dominant thought during strategy development.

### Vietnam 1965-1973: Second Employment of the Bomber in the Nuclear Age

During this period the B-52 was employed in a conventional role in Southeast Asia. The first B-52 strike against the Communists was on 18 June 1965. The primary role of the B-52 was not strategic but was interdiction. Secretary of Defense McNamara provided the rationale to use the B-52s over area targets.

We are faced with very, very heavy jungle in certain portions of South Vietnam, jungle so heavy that it is impossible to find an aiming point in it. We know some of these jungles are used by Viet Cong for base camps and for storage areas. . . . You can imagine that without an ability to find an aiming point there, there is only one way of bombing it and that is with a random pattern. . . . With the force we had (B-52s) trained as it was in pattern bombing . . . the military commanders felt--and I believe this was a proper use of the weapons--that these strikes would destroy certain of the Viet Cong based areas, and as a matter of fact, they did. . . . There is no other feasible way of doing it. We propose to continue.<sup>55</sup>

To carry out the interdiction campaign, the B-52 was modified. In the early 1960s the B-52D and B-52G models were modified to carry 27 internal bombs (up from 9) and 24 bombs on external racks. In October 1965 the B-52D was modified internally to increase the total carriage to 108-, 500-, and 750-pound bombs.<sup>56</sup> World War II type gravity weapons were still the primary ordinance for strategic bombers.

The target selection process in Southeast Asia was much different from that used in World War II or Korea. No longer did the senior staff debate the priorities of strategic targets. Instead,

Washington authorities still had reservations and placed severe controls on B-52 employment. One such control called for approval in Washington, sometimes at the White House level, of all proposed targets. In time, as Arc Light operations expanded, approval authority was delegated below the Washington level, but the White House, Office of the Secretary of Defense, and the JCS continued to receive information copies of all requests. There were other Arc Light restrictions which remained in effect throughout the war. These were primarily measures to safeguard noncombatants and religious shrines in target areas.<sup>57</sup>

The effectiveness of the B-52 in the interdiction role was demonstrated in several battles. The accuracy of the weapon drops and impact of the damage was highly acclaimed. General William C. Westmoreland observed several months after the battle of Khe Sanh, "The thing that broke their back basically was the fire of the B-52s . . . the heavyweight of firepower, was the tremendous tonnage of bombs dropped by our B-52s."<sup>58</sup>

The change of the role of the B-52 from interdiction to strategic bombing began on 9 April 1972 when B-52s conducted strikes on targets in North Vietnam. Some of the targets are summarized as follows:<sup>59</sup>

#### Linebacker I

<u>Date</u>	<u>Target</u>	<u>No. of B-52s</u>
9 April	POL storage, railroad yard	12
12 April	Bai Thuong airfield, 4 AAA sites	18
15 April	Haiphong POL storage, railway stock	17
21 April	Thanh Hoa area	18
23 April	Thanh Hoa area, rail lines, railroad bridge and thermal power plant	18

#### Linebacker II

18 December to	Rail and ship yards,	729
29 December	command and control facilities, warehouses, power plants, railway bridges, MiG bases, and air defense stocks	

Many of the targets in North Vietnam were similar to the strategic targets of World War II and Korea. Approximately 80 percent of North Vietnam's electrical power production and 25 percent of its POL were destroyed. By 28 December 1972 virtually all of the North Vietnam defenses had been destroyed. The greatest success came on 30 December 1972 when the North Vietnamese government agreed to resume peace talks. Subsequently an agreement was signed on 27 January 1973.

In summary, between June 1965 and August 1973, the B-52s flew 124,532 successful conventional sorties. By area, 55 percent of the sorties were flown against South Vietnam, 27 percent in Laos, 12 percent in Cambodia, and 6 percent in North Vietnam.<sup>60</sup>

The Vietnam War brought about changes in the carriage capability and bombing tactics of the B-52. However, much discussion continues on

the actual impact of the eleven-day strategic bombing on the termination of the war. Secretary of State Henry A. Kissinger, when asked about the impact of the bombing stated, "he did not want to speculate on North Vietnamese motives."<sup>61</sup> General David C. Jones, Chairman of the Joint Chiefs of Staff, observed, "Linebacker II served as a catalyst for the negotiations."<sup>62</sup> Whatever the answer, the Peace Accords were signed and US strategic bombers' active participation in North Vietnam was over.

### Summary

In this brief examination of strategic bombing strategy and the resulting weapon system, it appears that the conventional use of strategic bombers is an old problem. In early 1977 General David C. Jones testified to the Senate Armed Services Committee:

Common usage in the US has tended to make strategic forces almost synonymous with intercontinental nuclear forces in the minds of many. This conception is not shared by the Soviet Union and in my judgment forms too narrow a basis for US strategic thought.

Viewed more realistically, strategic forces include those which are aimed at deterring interference with our strategic interests. . . .

The more restrictive common usage is appropriate in certain specific contexts such as the (SALT) talks. However, we should not overlook the strategic importance of conventional forces by artificially concentrating exclusively on the intercontinental nuclear component of military capability. Furthermore, when judging the total contribution of our strategic nuclear forces, due consideration should be given to their synergistic relationship with nonnuclear forces and to the conventional capability of such strategic systems as the B-52.<sup>63</sup>

Nuclear weapons have altered how we have viewed military strategy for the past 30 years. However, this fact alone has not changed the necessity to determine our strategy and to build the weapon systems capable of responding to all levels of conflict. The nuclear weapon and its potential deterrent effect cannot be a substitute for the development of a viable conventional strategy in today's environment. The lessons of World War II and the constraints of Korea and Vietnam can serve as the basis for a new approach to strategic bomber employment in conventional conflicts.

## NOTES

### CHAPTER II

1. Colonel Thomas A. Fabyanic, USAF (Retired), "Strategic Analysis and MX Deployment," Strategic Review, Fall 1982, p.30.
2. United States Strategic Bombing Survey (New York: Garland Publishing Co., 1976). Quote from vol I, p. viii.
3. The Air Force, Air Corps Tactical School, Langley Field, Va., 1931, pp. 88-89.
4. Bombardment Text, Air Corps Tactical School, Maxwell Field, Ala., 1935, pp. 139-140.
5. Haywood S. Hansell, Jr., The Air Plan That Defeated Hitler (Atlanta, Ga.: Higgins-McArthur, 1972), pp. 41-48.
6. Air Force, Air Corps Tactical School, Maxwell Field, Ala., 1932-1933, p. 7.
7. Bombardment Text, pp. 49-76.
8. Letter from President Franklin D. Roosevelt to Secretary of War Henry L. Stimson, 9 July 1941.
9. Air War Plans Division-1, Munitions Requirements of the Army Air Forces (12 August 1941), part 2, tab 1, 2, 2B. (Hereafter referred to as AWP-1.)
10. AWP-1, part 2, tab 1, p. 2.
11. Air War Plans Division-42, Requirements for Air Ascendancy (9 September 1942), part IV, p. 2. (Hereafter referred to as AWP-42.)
12. AWP-42, tab B-1-a.
13. AWP-42, tab B-1-a.
14. Thomas A. Fabyanic, Strategic Air Attack in the United States Air Force: A Case Study (Manhattan, Kans.: Military Affairs/Aerospace Historian Publishing, 1976), p. 75.
15. Memorandum by the Combined Chiefs of Staff, CCS, 166/1/D1, Casablanca, 21 January 1943.
16. Ibid., p. 166/1/D.
17. Fabyanic, p. 78.



18. Ibid., p. 80.
19. Ibid., p. 92.
20. Urs Schwarz, American Strategy: A New Perspective (New York: Doubleday and Company, Inc., 1966), p. 33.
21. Albert Speer, Inside the Third Reich (New York: The MacMillan Company, 1970), p. 346.
22. Fabyanic, p. 95.
23. The United States Strategic Bombing Survey (Pacific War), report no. 1, p. 17. (Hereafter referred to as USSBS.)
24. USSBS (Pacific War), report no. 90, p. 2.
25. Wesley Craven and James Cate, eds., The Air Force in World War II (Chicago: University of Chicago Press, 1953), vol. V, p. 624.
26. Herbert Malloy Mason, Jr., The United States Air Force, a Turbulent History (New York, Charter, 1976), pp. 208-211.
27. Air Force Contribution to Mutual Reinforcement, Collateral Function Capabilities, USAF/USN Pamphlet, 1976. (Pages not numbered.)
28. John Kirk and Robert Young, Jr., Great Weapons of World War II (New York: Walker and Company, 1961), pp. 72-75.
29. Major General Haywood S. Hansell, Jr., Strategic Air War Against Japan (Maxwell AFB, Ala.: Airpower Research Institute, 1980), p. 99.
30. Ibid., p. 63.
31. Mason, p. 209.
32. Ibid., p. 235.
33. John Greenwood, History of the Strategic Bomber Since 1945 (Washington, D.C.: Office of Air Force History, 1975), tab J.
34. Mason, pp. 235-236.
35. Greenwood, tab J.
36. Kenneth P. Werrell, "The Cruise Missile: Yesterday, Today and Tomorrow," (Research report, Airpower Research Institute, Maxwell AFB, Ala., 1983), p. 34. (Unpublished)
37. USSBS (Pacific War). report no. 14, p. 4.

38. Robert Frank Futrell, The United States Air Force in Korea 1950-1953 (New York: Duell, Sloan and Pearce, 1961), p. 158.

39. Ibid., p. 176.

40. Ibid., pp. 178-179.

41. Kent W. Monroe, et al, Employment of the Manned Strategic Bomber in Nonnuclear War: A Perspective (Maxwell AFB, Ala.: Air War College, 1978), p. 9.

42. Russell F. Weigley, The American Way of War (New York: MacMillian Co., 1973), p. 404.

43. AFM 1-8, Strategic Air Operations (Washington, D.C.: Department of the Air Force, 1954), p. 4.

44. Department of Defense, Annual Report of the Secretary of Defense, 1 July 1958 to 30 June 1959, p. 3.

45. Monroe, p. 10.

46. Ibid., p. 11.

47. Department of Defense, Annual Report for Fiscal Year 1965, p. 12.

48. US Congress, House Committee on Armed Services, Hearings on Military Posture and H.R. 4016, 89th Congress, 1st Sess., 2 February 1965, p. 173.

49. Eugene Rabinowitz, Bulletin of Atomic Scientists, VI (July 1950):217.

50. Weigley, p. 443.

51. Fabyanic, p. 134.

52. AFM 2-11, Strategic Aerospace Operations (Washington, D.C.: Department of the Air Force, 1965), p. 3.

53. US Congress, House Committee on Armed Services, Hearings on the Department of Defense Decision to Reduce the Number and Types of Manned Bombers in Strategic Air Command, 89th Congress, 1966, pp. 6104-6105. (Hereafter referred to as HASC Hearing.)

54. Ibid., p. 6120.

55. Carl Berger (ed.), USAF in Southeast Asia (Washington, D.C.: Office of Air Force History 1977), p. 149.

56. Ibid., pp. 149-150.
57. Ibid., p. 150.
58. Ibid., p. 157.
59. Ibid., p. 166.
60. Ibid., p. 167.
61. Press Conference by US Secretary of State, 24 January 1973, quoted in Keesing's Contemporary Archives, 19-24 March 1973, p. 25789.
62. Supplement to the Air Force Policy Letter for Commanders, November 1973, p. 8.
63. General David C. Jones, "Strategic Issues," Supplement to the Air Force Policy Letter for Commanders, April 1977, pp. 10-11.

## CHAPTER III

### POLICY, STRATEGY, AND GUIDANCE

While strategic modernization is essential, nuclear forces are not a substitute for adequate conventional capabilities. The wide margin of nuclear superiority the West once enjoyed is gone forever. We can no longer, if we ever really could, rely on nuclear forces to compensate for weaknesses in conventional forces. Such weakness invites aggression and possible escalation to nuclear war. We can raise the nuclear threshold by having conventional forces that can fight at any level of conflict.<sup>1</sup>

General Charles A. Gabriel  
USAF Chief of Staff

Since the beginning of recorded history, men have fought among themselves. Their weapons have varied from the rock that Cain used to kill Able to the nuclear weapons that were dropped on Hiroshima and Nagasaki during World War II. The net effects of those weapons were the same: the adversary or enemy was slain and one man's will was imposed on another. Why do men and nations fight each other? Carl von Clausewitz puts it very simply. "Two different motives make men fight one another: hostile feelings and hostile intentions."<sup>2</sup> Cain is a good example of hostile feelings; the Nazi invasions in Europe and the Japanese bombing of Pearl Harbor were definitely hostile intentions. How do men get themselves in the position where they think that they must fight each other? Clausewitz' primary axiom states, "The political object--the original motive for the war--will thus determine both the military objective to be reached and the amount of effort it requires."<sup>3</sup> It has generally been accepted that Clausewitz was correct in this assertion. The military forces of the United States are an extension of the national political policy of this country. Let us suppose then, just for the sake of discussion, that two opposing forces have exactly the same amount of power. Would this allow peace to prevail? Clausewitz again has some thoughts relevant to our efforts:

Even if we suppose that circumstances could be completely balanced, or if we assume that insufficient knowledge of their mutual circumstances gives the commanders the impression that such equality exists, the differences in their political purpose will still rule out the possibility of a standstill. Politically, only one can be the aggressor: there can be no war if both parties seek to defend themselves. The aggressor has a positive aim, while the defender's aim is merely negative.<sup>4</sup>

The injection of the political motive is the destabilizing factor in the efforts toward a lasting peace. We have in the world today two major political powers that have exactly opposite points of view--the United

States and the Soviet Union. Both countries espouse the concept of providing for the defense of their respective countries. If both countries seek only to defend themselves, there can be no war. Right? Wrong. The Soviet Union has consistently demonstrated its expansionist desires in its actions. Under the guise of defense the Soviets have built a military force and have developed weapons that are unequalled in the free world. The Soviets obviously have the strategy, doctrine, tactics, and forces to achieve their objectives if there is no opposition from the free world. Do we see any indication of a change in Soviet policy? A glance at excerpts from a speech by Soviet Premier Leonid I. Brezhnev just prior to his death provides the answer.

The ruling circles of the United States of America have launched a political, ideological and economic offensive on socialism and have raised the intensity of their military preparations to an unprecedented level. They have unfolded an unprecedented arms race, especially a nuclear arms race, and are trying to attain military superiority. Our line is a line for detente and strengthening international security. The time now is such that the level of combat readiness of the army and navy should be even higher. It is necessary to perfect combat readiness in a constant and extremely responsible way, proceeding from the growing requirements. Then no fortuity will take us unawares. It is necessary to be able to operate with due account of the latest achievements of science and art of war. Competition in military technology has sharply intensified, often acquiring a fundamentally new character. A lag in this competition is inadmissible. We expect that our scientists, designers, engineers and technicians will do everything possible to resolve successfully all tasks connected with this.<sup>5</sup>

The Soviets are obviously not planning to slow down their development of the weapons of war. Yuri V. Andropov, Brezhnev's successor, continued this line of reasoning in a speech to the Communist Party Central Committee: "We know well that the imperialists will never meet one's pleas for peace. It can only be defended by relying on the invincible might of the Soviet armed forces."<sup>6</sup> While the Soviets are depending on their military forces, the United States has taken a somewhat different approach.

### Policy

President Ronald Reagan has spoken openly on the foreign policy of the United States. He has stated that US policy is built on three objectives: to rebuild the national defenses, to strive for legitimate arms reductions, and to be firm with totalitarian powers.<sup>7</sup> Expanding further he has said, "We have concluded that arms control must play a vital role in the conduct of our foreign policy and as a complement to our policy of deterrence. We are committed to deterrence."<sup>8</sup> On another occasion, the President said: "The prevention of conflict and the reduction of weapons are the most important public issues of our time."<sup>9</sup> All three of the President's objectives are designed for

implementing our deterrent policies. What then is deterrence and how can we define it? AFM 1-1, Functions and Basic Doctrine of the United States Air Force, provides us with one of the more succinct definitions:

Deterrence results from a state of mind brought about by perceived military power that presents an unacceptable risk to any nation planning hostile action. Deterrence exists in the minds of individuals. It stems from the perception by other nations of our capability, intent, and will.<sup>10</sup>

If, as previously stated, the military is an instrument of national policy, then where does the Air Force fit in this deterrent policy? No one service can totally carry out our deterrent policy. It will take a combined effort of the Army, Navy, Marines, and Air Force to ensure a credible deterrent. Since this study is confined to Air Force problems, let us take a look at the basic mission statement for the Air Force:

The mission of the United States Air Force is to prepare our forces to fight to preserve the security and freedom of the people of the United States. Our goal is peace. To achieve this goal we must deter conflict by maintaining a force that is capable and ready. . . . If conflict occurs, the Air Force will respond with actions as directed by the National Command Authorities. We will use the force necessary to resolve the conflict at its lowest level on terms favorable to the United States. To ensure that this capability and the will to use it are perceived as credible by all nations, the Air Force must be organized, trained, and equipped to develop forces that can prevail.<sup>11</sup>

"Peace," "deter," "capable," "ready" and "credible" are the key words in this mission statement. The Air Force must be ready to fight across the entire spectrum of potential conflicts. This spectrum ranges from diplomatic efforts at the lowest level to the highest level of conflict, which would be a strategic nuclear exchange.

Our strategic triad forces, consisting of the intercontinental ballistic missile (ICBM), sea-launched ballistic missile (SLBM), and manned bomber aircraft have provided, and will continue to provide, a credible deterrent force for the nuclear threat. Only if we keep these strategic offensive forces strong will we be able to operate at the lower levels on the spectrum of conflict.

In a recent major arms policy speech, President Reagan made the following statement on the Soviet and US imbalance:

The combination of the Soviets' spending more and the US spending proportionately less changed the military balance and weakened our deterrent. Today, in virtually every measure of military power the Soviet Union enjoys a decided advantage.<sup>12</sup>

Fortunately, the Reagan administration has taken action and made proposals to correct these deficiencies. The President has requested a \$274.1 billion defense budget for 1984. This budget request reinforces the President's five-point program for modernization of our strategic offensive forces and reveals the decline in our strategic capabilities. The President's program consists of the following:<sup>13</sup>

- (1) Improve our communications and control systems.
- (2) Modernize our manned strategic bomber force. (Modernize existing B-52s, deploy B-1B, and develop the advanced technology bomber.)
- (3) Deploy new, more accurate sea-launched ballistic missiles. (The D-5 or Trident II missile.)
- (4) Improve the survivability of new land-based intercontinental ballistic missiles. (Develop MX and deploy in a survivable basing mode.)
- (5) Improve strategic defense, including civil defense.

If the President's programs are carried out, then the nuclear balance will once again approach credibility. However, the President's former Special Assistant Thomas C. Reed pointed out, "Failure to strengthen the nuclear deterrent could be disastrous. Yet our nuclear shortcomings mean that a credible conventional deterrent is more important than ever."<sup>14</sup>

The Soviets have made no effort to hide their expansionist policies. They will use surrogate or proxy forces and even direct intervention by their own military to propagate their political aims. This policy has expanded the traditional "potential conflict areas" to almost anywhere on the globe. The requirement for worldwide capability creates new problems for the Air Force. We now must provide force projection to all parts of the world to counter Soviet aggression. According to General Gabriel, we cannot rely on our nuclear forces to respond in conventional areas of conflict. We must maintain conventional strength if deterrence is to work. How do we get an accurate perspective of the forces and conventional weapons necessary to insure a credible deterrence? A review of our national security strategy and military strategy should provide a starting point.

### Strategy

The President has stated, "The primary function of the federal government is the national security."<sup>15</sup> Just what is our national security strategy? Former Special Assistant to the President Thomas C. Reed describes our national strategy as follows:

Foreign policy and defense planning must be conceived and executed around certain basic principles and objectives. In the case of the United States, we see these as being the preservation of our political principles and institutions as embodied in our Declaration of Independence and Constitution; secondly, the protection of our people and their belongings from military, paramilitary or terrorist attack; thirdly, the promotion of the economic well-being of our people; and last, the fostering of an international order supportive of these institutions and principles fostering "the infrastructure of democracy."<sup>16</sup>

National strategy is broken down into four broad areas of strategy. We must (1) pursue diplomatic and political strategies for all parts of the world, (2) assist in the development of an international economic strategy, (3) establish an informal strategy to tell the world about freedom, and (4) develop military strategy that links all of these together. This last area, military strategy, is vitally important and merits further attention.

The essence of our military strategy is to foster the improvement of treaties and relationships with our allies and friends. Integral to this military strategy is the notion of joint cooperation for mutual defense and the realization that all nations of the world are interdependent. Continued access to natural resources and the world trade markets must be maintained if peace is to be realized. Freedom of the seas and unimpeded access to space must be maintained. The strategic nuclear deterrent forces must be modernized and conventional capabilities must be developed to insure the protection of our interests and to prevent war. The proliferation of nuclear weapons in the world must be discouraged. Finally, the security of the United States cannot be assured by arms alone. This military strategy poses many challenges for the decade of the eighties.<sup>17</sup>

#### Guidance

How do we translate broad thoughts on military strategy into something that is tangible? In his 1983 defense report, Secretary of Defense Caspar W. Weinberger said:

Defense policy and military strategy have to be renewed to adjust to the changed world environment, overcome obsolete concepts and thinking, and take full advantage of US and allied capabilities. But the best strategic thinking will be of little use unless it can be translated into concrete policy decisions, budgetary choices, and specific strategic plans.<sup>18</sup>

Defense planning to carry out the national strategy is a very convoluted process. In 1981 Secretary of Defense Weinberger made some major improvements in the Planning, Programming, and Budgeting System (PPBS), which had been growing more and more cumbersome each year.



Under the old PPBS the programming function was overemphasized and appeared to be driving our strategic planning. The revitalized planning process, as outlined by Secretary of Defense Weinberger, allows an iterative process with emphasis on planning. The direct inputs of the military users, the Joint Chiefs of Staff, and the commanders of the unified and specified commands are now considered at all levels of the process.<sup>19</sup> The result of this process is the annual publication of a document called the defense guidance (DG). The DG serves as the basic guidance for all DoD planners and program managers.

All Air Force plans and programs are directed toward carrying out the defense objectives. A condensed listing of these objectives may help focus our perspective.

(1) Defense efforts must contribute to our national security objectives and further our foreign policy. These efforts should make the cost of war unacceptably high to any potential aggressor and put his own interests at risk.

(2) All supply and communication lines should be kept open in peace and in war.<sup>20</sup>

(3) The Department of Defense and the services must maintain a strong nuclear deterrence. This would aid the United States in negotiations for arms control.

(4) Our main effort should be on strategic modernization since this is the area where we must not fail. Nuclear war would make our other efforts unnecessary by comparison.

(5) To insure readiness and sustainability, we must maintain a responsive industrial and mobilization base.

(6) The military services should maintain rapidly projectable forces to areas of potential conflict, insure air superiority in those areas, and keep the maritime sea lines of communication (SLOCs) open for use by the United States and our allies.

(7) Superior technology should be exploited and put to military use.<sup>21</sup>

Where does this lead us? Policy and strategy considerations are important, but today's economics appear to be the prime driver in determining the course we are taking. How do we match forces and strategy in an economically constrained environment? In the past we have not put forth the budgetary efforts necessary to keep up with the Soviet Union. We are now seeing the shortcomings of that policy. The Secretary of the Air Force Verne Orr and General Lew Allen, Jr., former Chief of Staff, US Air Force, stated this view clearly:

Two decades of massive military spending have underwritten an awesome expansion of Soviet weaponry across the full spectrum of military capabilities. Over the past decade alone Soviet defense spending has exceeded comparable US spending by more than 40 percent. The Russians devote 12-14 percent of their annual GNP to the military compared to less than 7 percent in this country. As a consequence, the USSR has overcome many of the military advantages previously possessed by the West and has matched or surpassed us in important measures of military power. The Soviet Union has altered both the reality and perception of the global military balance. This increased strength has given Moscow the confidence to undertake military actions it might have considered too risky a decade ago when the balance favored the West.<sup>22</sup>

Can we achieve both strategic and conventional deterrents in a fiscally constrained environment? Close scrutiny of the President's modernization program could provide some insight. The number two item on the list is modernization of existing B-52 bombers, production and deployment of the new B-1B, and accelerated development of the advanced technology bomber (ATB). All of these long-range aircraft have inherent conventional capabilities as well as the ability to perform a primary nuclear strike role. In a joint statement two of our top Air Force leaders, Secretary of the Air Force Orr and General Allen said:

Airpower plays a particularly critical role in our flexible response strategy. Airpower, because of its long range, speed, and flexibility, allows the most efficient allocation of forward deployed and central reserve forces. . . . As with defense in Europe, airpower, . . . provides an essential element of our combined arms deterrent to discourage aggression or coercion in other parts of the world. Our ability to deploy forces rapidly and to disrupt and delay enemy advances via interdiction strikes by long-range aircraft is a critical element of our defense strategy.<sup>23</sup>

These gentlemen go on to say:

The wartime effectiveness of modern aircraft will be only as good as the munitions they carry. Our present munitions inventory is inadequate because much of this inventory consists of older, less capable munitions, and our stocks are insufficient to support a high intensity, prolonged war.<sup>24</sup>

The operative words in the above paragraphs are long-range aircraft, effectiveness, and munitions. Before expanding the development of munitions or aircraft, however, we should be reminded of what impact technology has had on survivability in combat.

## NOTES

### CHAPTER III

1. General Charles A. Gabriel, USAF, "Open to New Ideas," Air Force Magazine, 65, no. 9, (September 1982):100.
2. Carl von Clausewitz, On War, ed. and trans. by Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), p. 76.
3. Ibid., p. 81.
4. Ibid., p. 216.
5. Leonid I. Brezhnev, speech to Kremlin and high military officials, 27 October 1982, as reprinted in New York Times, 28 October 1982, p. 7.
6. Yuri V. Andropov, speech before the Communist Party Central Committee, 12 November 1982, as reprinted in the New York Times, 13 November 1982, p. 4.
7. Ronald Reagan, Presidential documents, p. 995.
8. Ronald Reagan, Presidential documents, p. 959.
9. Ronald Reagan, speech on arms policy, 22 November 1982, as reprinted in New York Times, 23 November 1982, p. A12.
10. AFM 1-1, Functions and Basic Doctrine of the United States Air Force (Washington, D.C.: Department of the Air Force, 1979), pp. 1-7.
11. Ibid., p. v.
12. Ronald Reagan, "Reagan Strategic Outlook," text of a major speech on arms policy given by President Reagan, 22 November 1982, as reprinted in New York Times, 23 November 1982, p. A12.
13. Caspar W. Weinberger, Annual Report to the Congress, Fiscal Year 1983 (Washington, D.C.: US Government Printing Office, 1982), pp. I-39, 40.
14. Thomas C. Reed, "Banquet Address," Signal 20, (August 1982):29.
15. Ronald Reagan, White House press conference, 11 November 1982.
16. Reed, p. 25.

17. Ibid., p. 26.
18. Weinberger, p. I-43.
19. Ibid., pp. III-198.
20. Defense Guidance FY 84-88 (Secret), 22 March 1982, p. 7.  
(Note: Although the DG is classified secret overall, all references in this study are unclassified.)
21. Ibid., p. 8.
22. Verne Orr and General Lew Allen, Jr., USAF, "The Posture of the Air Force and Budget Estimates for Fiscal Year 1983," a Department of the Air Force joint statement before committees and subcommittees of the US Senate and the House of Representatives, 2d Sess., 97th Congress, p. 3.
23. Ibid., pp. 1-2.
24. Ibid., p. 29.

## CHAPTER IV

### ATTRITION AND TECHNOLOGY

Clausewitz states, "the defensive form of warfare is intrinsically stronger than the offensive."<sup>1</sup> As we have seen in past wars, a determined defense can extract a heavy toll from an attacking force. In modern wars, World War II to present, we have numerous examples of an increasing defensive threat. Improvements in antiaircraft artillery (AAA), the introduction of surface-to-air missiles (SAMs), and vastly improved interceptor aircraft, with look down/shoot down (LDSD) capabilities, have all added to the difficulties in mounting an offensive or counteroffensive effort. The cost of our aircraft weapon systems has steadily increased. For instance, the B-17 was produced for about \$640,000 in a combat configuration. The B-18, if only 100 are produced, will cost at a minimum \$205 million each. The B-52, no longer in production, is an irreplaceable asset. With these increased costs we are able to buy an inordinately small force of strategic aircraft as compared to the days of World War II. For example, we built 12,731 B-17 Flying Fortresses for use in that war and lost over 4,750 in combat.<sup>2</sup> Today a limited buy of 100 B-1Bs and only 241 remaining B-52Gs and B-52Hs are all we have available to carry the bulk of our strategic attack force. It is not difficult to see that we can no longer afford to sustain high-combat losses. We need to find a way to make these limited assets of today more survivable and effective. But first, let us take a look at what some of the losses were during previous wars and what were the contributory factors.

#### World War II

In World War II our highest bomber losses came in the European theater. We lost 4,891 heavy bombers (B-17, B-24, B-32) and 623 medium and light bombers (B-25, B-26, A-20, A-24, A-26, A-36). These losses were broken down as follows:

Heavy bomber losses	2,452 Enemy fighters
	2,439 AAA
Medium and light bomber losses	131 Enemy fighters
	492 AAA

The heavy bombers flew 274,921 effective sorties and the medium and light bombers, 96,523. Calculations then show us a loss rate of less than two percent per sortie for the entire war.<sup>3</sup> The loss of bomber aircraft, specifically the B-29, was not as great in the Pacific theater against Japan. The B-29s of the Twentieth Air Force flew 31,387 sorties and lost only 414 aircraft. These losses were attributed to 50 percent by enemy fighters, 36 percent to AAA, and 13 percent to a combination of both. This placed the attrition rate at a nominal 1.3 percent, a very acceptable level for combat.<sup>4</sup>

### Korea

The first use of strategic bombers in a conventional role during a limited conflict was in Korea. B-29s of the Far Eastern Air Force (FEAF), almost exclusively made up of SAC personnel and aircraft, flew 21,328 effective combat sorties and dropped 167,000 tons of bombs on various targets, ranging from front line enemy troop emplacements to airfields on the banks of the Yalu River.<sup>5</sup> Losses of B-29s during the Korean conflict were kept to a minimum by almost complete air superiority.

### Vietnam

On 18 June 1965, bombers of the Strategic Air Command, this time B-52Fs, were used for the first time in a conventional role against targets in the Vietnam conflict.<sup>6</sup> On 15 August 1973, after over eight years of conventional bombing operations in Southeast Asia, the B-52s came home.<sup>7</sup> During that entire period, only 15 aircraft were lost because of enemy action. All these losses were during Linebacker II, better known as the eleven-day war, in December of 1972. A total of 729 combat sorties were flown in December of 1972 by B-52Ds and B-52Gs, for an attrition rate of approximately two percent.<sup>8</sup> All Linebacker II sorties were flown against North Vietnam, primarily the Hanoi/Haiphong area, which experienced Air Force officers called the most heavily defended targets in the history of aerial warfare. The North Vietnamese used AAA, Soviet MiG fighter aircraft, and surface-to-air missiles (SAMs) in a dedicated effort to defend these targets. It is estimated that the North Vietnamese fired approximately 884 missiles at B-52s during the eleven-day war. Of these missiles, only 24 missiles found their mark and accounted for the 15 lost aircraft. The other nine aircraft returned to base. AAA damaged only one B-52 and it too returned home.<sup>9</sup>

During all of these wars our bombers used free-fall iron bombs and overflew the target area. A more recent conflict may indicate that this method of conducting strategic conventional bombing should be reviewed.

### The Falklands

The Falklands crisis, a confrontation between Britain, a major power, and Argentina, a third world country, has provided us with many points to ponder about defenses, attrition, and how future conflicts will be fought. If the Vietnam conflict could be viewed as the beginning of actual application of electronics in warfare, then the Falklands crisis would surely qualify as the point at which modern air-to-surface missiles were applied in a limited conventional conflict. The combat forces of both Britain and Argentina were in a considerable state of transition in both technology and force structure.<sup>10</sup> British

Harrier aircraft had to be modified rapidly to accept Sidewinders (AIM-9L) air-to-air missiles. Vulcan bombers, Nimrods, and C-130s had to be modified for air refueling. The Nimrods were also fitted with the Harpoon antiship missile. These changes all took place after hostilities began.<sup>11</sup> The air-to-ground weapons of Britain were still primarily general purpose, gravity bombs. The Argentines had a small air force, the inventory of which was almost 20 years old. The most sophisticated Argentine aircraft, the Super Etendard, had Exocet antiship missiles. The Argentine interceptors had some older air-to-air missiles but no electronic countermeasures, and they too had only general purpose free-fall bombs for attack.<sup>12</sup> Surface-to-air and ship-to-air missiles were to be found on both sides.

The material losses on both sides were severe. First, let us discuss the British losses and their causes. The British ships HMS Sheffield (destroyer) and Atlantic Surveyor (container ship) were sunk by long-range, sea-skimming Exocet missiles launched from Super Etendard aircraft.<sup>13</sup> This represents a high attrition rate in British ships as against an economical expenditure of relatively low-cost missiles, especially as none of the launching aircraft was shot down.<sup>14</sup> In addition, the British ships Coventry, Antelope, Ardent, and Sir Galahad were sunk and the Sir Tristran beached, all as a result of conventional 500- and 1,000-pound bomb attacks.<sup>15</sup> For these latter ships, the Argentine air force paid dearly. All told the Argentines lost between 105 and 109 aircraft to all causes. Harrier "jump jets" accounted for 31 kills, 24 of those with the advanced technology AIM-9L, Sidewinder missile. Modern surface-to-air and ship-to-air missiles added 37 more Argentine aircraft losses. The remainder of airborne combat losses (7) were to small arms fire. The Argentines flew 505 combat missions and lost approximately 75 aircraft for a 15 percent attrition rate.<sup>16</sup> That rate of attrition could hardly be sustained by any air force in any conflict for more than a few days of combat. Beyond the loss of the aircraft, a large number of Argentina's experienced pilots were lost in this conflict. These pilots were irreplaceable at any price.

The Argentines lost only one ship to combat action, the General Belgrano (cruiser), which was sunk by a British submarine using World War II torpedoes.<sup>17</sup> The British acknowledged 34 aircraft lost, but only 13 to direct combat causes and none to ground defenses. The French, co-manufacturer of the Roland surface-to-air missile system, claimed that their system, operated by Argentine forces at Port Stanley, destroyed four Harriers and a probable fifth.<sup>18</sup> The indications favor the French analysis since the Roland is a highly credible system. Whatever the true story is, the British did face a much less sophisticated defensive threat to its air forces. The attacks on the Port Stanley airfield provide another indication of the limitation of direct overflight and free-fall conventional ordnance. The airfield was attacked five separate times by Vulcan bombers, delivering 21 one-thousand-pound, conventional bombs each time. These attacks were usually followed by Harrier strikes. The ineffectiveness of these weapons is attested by

the fact that the runway was still in use by the Argentines on the last day of the conflict.<sup>19</sup> Stewart W. B. Menaul, a former British air vice-marshal, stated:

Cluster bombs and 1,000-pound iron bombs were not effective against the airfield at Port Stanley and serve to emphasize that last-war weapons and last-war tactics will not prevail in a potential war in Europe against the world's most heavily armed nation.<sup>20</sup>

So where does this review of defenses and attrition factors lead us? Clausewitz warns us before we go forward:

In short, absolute, so called mathematical factors never find a firm basis in military calculations. From the very start there is an interplay of possibilities, probabilities, good luck and bad that weaves its way throughout the length and breadth of the tapestry. In the whole range of human activities, war most closely resembles a game of cards.<sup>21</sup>

In short, the "fog and friction" and "uncertainties of war" can play a big part in any analysis. As a case in point, we have already seen from history that our loss rate in the European theater during World War II was less than two percent. But after the war and using modern methods of war-gaming, the Army claimed that the B-17 and B-24 bombers could not survive in combat against German fighters and 88-millimeter antiaircraft. General LeMay commented on this, "Experience, I think, is more important than some of the assumptions you make."<sup>22</sup> The weapons of war change but defenses in war, at least until the turn of the century, will still consist of AAA, SAMs, and interceptor aircraft. Any air-to-ground attack may face any combination of increasing Soviet defensive weapons, such as the SAM-4, -5, -6, -7, -8, -9, -10, as well as the lethal ZSU-23-4 AAA guns. Then how should we view our choices in future conflicts? An excerpt from the 1982 policy statement of the Air Force Association summarizes such choices nicely:

The potential for attrition in modern warfare is dramatic; our vital, reusable aerial delivery system must not be exposed . . . unnecessarily long-range, standoff weapons with all weather capability must be developed and produced. . . . the Air Force has to maintain an effective tactical air arm by exploiting the US technological edge and by emphasizing systems that achieve higher effectiveness through accuracy and lethality while reducing aircraft attrition through standoff capability. Sufficient stocks of modern, effective munitions are essential to our war-fighting capability. The Air Force has a large stockpile of aging Vietnam-era munitions, characterized by gravity bombs and general lack of precision guidance. While they remain reliable weapons, they are ill-suited to counter growing Soviet capabilities. Efforts must continue to improve the quality and size of the munitions inventory to reduce the attrition of USAF forces.<sup>23</sup>



With an increasingly lethal defensive threat the management of attrition will become a prime consideration for future strategists and planners. What are some of the possibilities to counter attrition? In the past we have modified aircraft tactics and used electronic counter-measures (ECM) to counter changes in the defensive threat. Let us make a quick review of our efforts in past conventional conflicts.

During World War II our bomber forces initially depended upon mass formations for mutual defense against fighter aircraft. Altitude and ECM were good defenses against AAA. Some analysts believe that ECM reduced our attrition rate by at least 25 percent.<sup>24</sup> Our most effective defense against German fighters was the P-51 fighter escort with long-range tanks. Our losses in that war have already been cited. The SAM had yet to be introduced in combat.<sup>25</sup>

In the Korean War we continued to use tactics of World War II for bombers that were flown primarily at night to avoid North Korean fighter intercepts. In Korea, as in Vietnam, we achieved virtually complete air superiority over our enemy. This allowed our air forces a larger degree of freedom and was the key factor in reducing our aircraft losses.

Interestingly, the AAA was the largest contributor to our losses in Vietnam and accounted for about 68 percent of the total losses. SAMs destroyed their first aircraft in July of 1965. The high-altitude accuracy of SAMs forced our fighters into the range of the more intense AAA environment. Almost all SAMs (about 200 sites) were located in North Vietnam, and no mobile SAMs (SA-4 and SA-6) were deployed throughout the war.<sup>26</sup> The combination of SAMs and AAA caused our attacking fighter bombers to use degraded tactics and surely reduced our overall sortie effectiveness. World War II, Korea, Vietnam, and the Falklands, all drive home the point that there must be a better way to attack ground targets while reducing attrition of attacking aircraft. In 1982 the Israeli operations in Lebanon gave us a precursor of things to come and showed us the practical application of advanced technology to the battlefield.

#### Lebanon 1982

The Israeli advance into Lebanon in 1982, designated Operation Peace for Galilee, provides the latest example of the application of high-technology conventional weapons in limited wars. However, before discussing the actual conduct and results of this military action, we must express a few words of caution. Extrapolation of these operations to other areas of the world, in a generalized fashion, should be done with great care. The geographical size of the combat area was small and positions were well defined. The distance from the main operating bases (MOBs) to the strike zone was minimal and minimized the logistics problems. Preparation time was available to insure a fully coordinated air and ground attack for maximum effectiveness. The Israelis also had

a priori knowledge of the defenses and therefore were able to develop an overall strategy and defense system that neutralized the majority of the threats very early in the battle.<sup>27</sup>

In other words, this was a favorable situation in which to employ advanced technology systems. In conflicts where we must have rapid force projection on a worldwide basis on short notice, we may not be afforded the luxury of this situation. With these considerations in mind, we can still learn some valuable lessons from Operation Peace for Galilee. One authoritative author arrived at this very astute conclusion after reviewing the results of the British battle in the Falklands and the Israeli confrontation in Lebanon:

Nevertheless, a comparison with the weapon systems and tactics used by the Israelis in Lebanon suggests that in the Falklands Britain was fighting yesterday's war, while in Lebanon Israel was fighting tomorrow's. It will behoove the Western Alliance as a whole to study the lessons and draw the necessary consequences so that it will not risk the penalty of waging yesterday's war on the ever more sophisticated battlefields of tomorrow.<sup>28</sup>

The Israelis were, from previous experiences, fully aware of the serious impact of a sophisticated defensive system on combat operations. The planners must have remembered a favorite phrase of Clausewitz, "Everything in war is very simple, but the simplest thing is difficult."<sup>29</sup> They kept the plan simple and relied on brilliant execution by air and ground forces.

The Israeli air force (IAF) had two primary objectives: destroy the SAM-6s in the Beqa'a Valley and maintain complete air superiority. They accomplished both missions with such ease that it surprised even the Israelis.<sup>30</sup> Two Israeli soldiers who were not surprised were Major General Benny Peled, a former IAF commander, and Major General David Ivri, the present IAF commander. After the 1973 Yom Kippur War, these two men knew that they had to prepare for the "new" warfare. General Peled initiated a heavy investment in resources and research to find the solutions that were used by the IAF in 1982. General Ivri was also convinced of this need and trained the IAF for the future.<sup>31</sup> That foresight and training paid off. Nineteen SAMs and 86 Syrian aircraft were destroyed. IAF losses were minimal; only one A-4 Skyhawk was lost.<sup>32</sup>

The Israelis used some of the most advanced weapons and technology available today to achieve these remarkable successes. Remotely piloted vehicles (RPVs), such as the Israeli Aircraft Industry "Scout" and Tadiran "Mastiff," and a surface-to-surface anti-radiation missile, the new Israeli Zeev "Wolf," were a part of the total system. This system also included an electronic warfare aircraft (a modified Boeing 707), an airborne early warning aircraft (a Gruman E-2C), and modern US fighters (A-4, F-15, and F-16) equipped with advance technology weapons. These US weapons were instrumental in the Israeli successes: the AIM-9L (Sidewinder for air-to-air), the new Maverick missile (standoff

air-to-surface), GBU-15 glide bombs (standoff), antiradiation missiles (standard arm and strike), and cluster munitions such as the BLU-72.<sup>33</sup>

The point here is not to focus so much on the hardware but on how this system was put together. Retired Israeli Army Major General Chaim Herzog, a leading military and political commentator, said it best:

However, when evaluating the results of the Beqa'a air battle, sight should not be lost of the fact that the confrontation which took place was not merely one between the aircraft and the missile. It was one between two complex technological systems, including most modern and highly sophisticated air control and electronic communications equipment. These two systems were tested in battle, both in the destruction of the missile and in one of the major air battles in modern history. The control and direction of such an operation, and the orchestration required for all the elements involved, is highly complex, and thus despite the very sophistication of the equipment the human element still remains a dominant one.<sup>34</sup>

The combination of the proper strategy with the increased capabilities of these new technology systems provided the leverage the Israelis needed in this recent conflict. The Syrian ground and air defenses were defeated and the Israeli army was free to advance. The point is that advanced technology weapons and sophisticated systems will work and have worked in a combat environment with a high degree of reliability and effectiveness. This lesson has not gone unnoticed by some of our military leaders.

#### The High-Technology Approach

Secretary of the Navy John Lehman states: "there is no substitute for the high-technology approach."<sup>35</sup> Air Force Chief of Staff General Charles A. Gabriel goes even further and expresses a determination to exploit technological change to its fullest.<sup>36</sup> There appears to be within the United States a consensus of opinion on the need to pursue new technological advances in our weapon systems. But the question remains: How are we really doing? Can we afford to spend the money required to develop new weapons and strengthen our conventional capabilities? The rising cost of military programs is the subject of many sessions in Congress. As always the domestic economic consideration constrains our strategy and policy decisions.

Our most rapidly deployable force, in this case the SAC (B-52) SPF, is being outfitted to carry only the old general purpose bombs of World War II. The new B-1B is being certified to carry this same family of old conventional munitions. If we are to learn from these recent conflicts, it should be that we need new technology munitions, not more of the same old ones. Norman Augustine, chairman of the Defense Science Board, puts our needs in the proper perspective:

Clearly, the solution is not to be found in delivering more ordnance. The leverage is in "finding" and "hitting" the target . . . functions which technological advancements of the past decade now make generally attainable through modern surveillance, command and control, weapon delivery, and guidance.<sup>37</sup>

. . . the U.S. possesses an increasing number of superb tactical aircraft platforms today. It is time to turn our attention, with due urgency to the ordnance these aircraft will deliver to suppress defenses and destroy primary targets, and to the related target acquisition systems which will support them.

No less than a Manhattan-type project is deserved for so important a task. Unfortunately, no less than a Manhattan-type project will be required.<sup>38</sup>

In today's environment of mass media and rapid dissemination of information on a worldwide basis, a Manhattan-type project may not be feasible. However, the weight of effort applied to the development of new technology conventional weapons should be no less than that project or equal to our effort to put a man on the moon in the 1970s. Both of those projects were highly successful, the latter even supported by the American public. With the current emphasis on freeze of nuclear weapons, strategic arms reduction talks (START), with possible force reductions, the importance of conventional forces increases. It appears that a combination of the LRCA and new technology conventional standoff weapons could be cost effective and could provide rapid response to crisis situations with sufficient firepower in conventional conflicts.

A new family of conventional weapons could and should be developed with emphasis on improved standoff capability. These weapons will not be revolutionary but in fact are already on the drawing boards and in development. We have long had the knowledge and capability to build improved standoff conventional weapons. However, technology has, only within the last decade, given us the ability to combine standoff with precision guidance for weapons' delivery. The idea of standoff conventional weapons is not new.<sup>39</sup> It does deserve to be revitalized, based on our new technological capabilities. No amount of money can develop the technologies needed for tomorrow if we do not start investing today. The industrial base simply will not be able to change rapidly enough to meet requirements. In the effort to develop new technology conventional weapons, time is definitely not on our side.

Predictions of technological developments have been poor. The following excerpt from the 1976 Congressional Record exemplifies our technology forecasting:

In 1878, Frederick Engles stated that the weapons used in the Franco-Prussian war had reached such a state of perfection that further progress which would have any revolutionary influence was no longer possible. Forty years later, the following unforeseen systems were used in World War I: Aircraft, tanks, chemical warfare, trucks, submarines, and radio communications. A 1937 study

entitled "Technological Trends and National Policy" failed to foresee the following systems, all of which were operational by 1975: Helicopters, jet engines, radar, inertial navigators, nuclear weapons, nuclear submarines, rocket powered missiles, electronic computers and cruise missiles. The 1945 Von Karman study entitled "New Horizons" missed ICBMs, man in space [and so on], all operational within 15 years.<sup>40</sup>

With poor historical predictions should we simply resign ourselves to "making do" with today's technologies and weapons? Hardly. John M. Collins makes a most valid point with this statement: "Technological warfare, which connects science with strategy and tactics, is deliberately designed to outflank enemy forces by making them obsolete. Battles are won by budgeteers and men at drawing boards before any blood is shed."<sup>41</sup> We cannot afford to wait until the first "blood is shed" to start our development of these new technology conventional weapons.

## NOTES

### CHAPTER IV

1. Carl von Clausewitz, On War, ed. and trans. by Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), p. 358.
2. Edward Jablonski, Flying Fortress (Garden City, N.Y.: Doubleday and Co., Inc., 1965), p. 309.
3. AAF Statistical Digest, World War II, pp. 221, 255.
4. Major General Haywood S. Hansell, Jr., USAF (Retired), Strategic Air War Against Japan (Maxwell AFB, Ala.: Airpower Research Institute, 1980), pp. 71-72.
5. Office of the Historian, The Development of Strategic Air Command 1946-1981 (Offutt AFB, Nebr.: Strategic Air Command, 1982), p. 41.
6. Ibid., p. 129.
7. Ibid., p. 183.
8. Corona Harvest Final Report, "USAF Air Operations in Southeast Asia," 1 July 1972-15 August 1973, vol. 2, book 4, p. 298.
9. USAF Southeast Asia Monograph Series, vol. VI, mono. 8, Linebacker II: A View From the Rock, Brigadier General James R. McCarthy, Lieutenant Colonel George B. Allison (Maxwell AFB, Ala.: Airpower Research Institute, 1979), pp. 171-172.
10. Anthony H. Cordesman, "The Falklands Crisis: Emerging Lessons for Power Projection and Force Planning," Armed Forces Journal International, September 1982, p. 32.
11. Charles W. Corddry, "Britain's Near-Thing Victory," Air Force Magazine 65, no. 12, (December 1982):53.
12. Air Vice Marshall Stewart W. B. Menoul, RAF (Retired), "The Falklands Campaign: A War of Yesterday?", Strategic Review, vol. X, no. 4 (Fall 1982):87.
13. Edgar O' Ballance, "Falkland Islands--The San Carlos Landing," Marine Corp Gazette, 66, no. 10 (October 1982):37, 44.
14. Menoul, p. 87.
15. Cordesman, p. 44.

16. Ibid., p. 32.
17. O' Ballance, p. 37.
18. "Exocet, Roland Combat Performance Rated High," Aviation Week and Space Technology 117, no. 18 (November 1982):26.
19. Menoul, p. 89.
20. Ibid., p. 90.
21. von Clausewitz, p. 86.
22. 88th Congress, 1st Sess., "Military Procurement Authorization Fiscal Year 1964," Hearings before the Committee on Armed Services, US Senate (Washington, D.C.: US Government Printing Office, 1963), pp. 948-949.
23. Air Force Association, "Toward Adequate Airpower for Tomorrow," Air Force Magazine 65, no. 11 (November 1982):48.
24. General William W. Momyer, USAF (Retired), Air Power in Three Wars (WWII, Korea, Vietnam), undated, publisher unknown, p. 126.
25. DeWitt S. Copp, Forged In Fire, Strategy and Decisions in the Air War over Europe 1940-45 (Garden City, N.Y.: Doubleday and Company, Inc., 1982). This book is recommended reading for avid students of military history. It recreates our offensive and defensive bombing efforts in WWII.
26. Momyer, p. 123.
27. John Frecker, Joe Whitmore, and John J. Lindsay, "Mismatch in the Sky," Newsweek, 21 June 1982, p. 24.
28. Menoul, p. 91.
29. von Clausewitz, p. 119.
30. Clarence A. Robinson, Jr., "Surveillance Integration Pivotal in Israeli Successes," Aviation Week and Space Technology, 5 July 1982, p. 17.
31. Chaim Herzog, The Arab-Israeli Wars (New York: Random House, 1982), p. 399.
32. Menoul, p. 89.
33. Robinson, pp. 17-18.
34. Herzog, p. 400.

35. Edgar Ulsamer, "In Focus. . . .", Air Force Magazine, 65, no. 11 (November 1982): p. 24.

36. General Charles A. Gabriel, USAF, "From Silk Scarf to Spacecraft," Air Force Magazine 65, no. 11 (November 1982):80.

37. Norman R. Augustine, "Military Electronic/Countermeasures," IEEE Forum, April 1982, pp. 37, 40. This article addresses the arguments for standoff weapons and presents some unique analysis. Recommended reading.

38. Ibid., p. 43.

39. For a brief analysis of standoff tactics and history of those tactics, see Captain George J. Seiler's study on "Strategic Nuclear Force Requirements and Issues," Airpower Research Institute, Research Report No. AU-ARI-82-1, Maxwell AFB, Ala., pp. 206-219. For an in-depth review of the historical perspective on cruise missiles, see Dr. Kenneth P. Werrell's study, "The Cruise Missile: Yesterday, Today, and Tomorrow" (Research report, Airpower Research Institute, Maxwell AFB, Ala., 1983). (Unpublished)

40. George Heilmier, Congressional Record, 22 June 1976, p. S10139, as quoted in John M. Collins, U.S.-Soviet Military Balance--Concepts and Capabilities 1960-1980, p. 102.

41. John M. Collins, U.S.-Soviet Military Balance--Concepts and Capabilities 1960-1980 (New York: McGraw-Hill Publications Company, 1980), p. 101.



## CHAPTER V

### NEW TECHNOLOGY WEAPONS FOR CONVENTIONAL CONFLICTS

The venerable B-52, even though the average age of all models now exceeds 23 years,<sup>1</sup> is still a good conventional bomber. The B-52D more than proved its conventional capabilities during the Vietnam conflict but is now in the process of being retired. The B-52G was also used extensively in a conventional role in Vietnam. These two aircraft provided the backbone of the crippling strikes on North Vietnam during the 1972 Linebacker II missions. A number of B-52Hs, the longest range combat aircraft currently in the Air Force inventory, form the strike arm of the SAC strategic projection force (SPF). These H models have participated in exercises such as the November 1981 Bright Star, the 1982 exercise in Egypt,<sup>2</sup> and the December 1982 Jade Tiger exercise in Oman.<sup>3</sup> The exercises were conducted from home bases in the United States in conjunction with the US Rapid Deployment Force (RDF), of which the SPF is a part. They demonstrated the potential of conventional force projection. As far as we can tell, these tried and true performers will be carrying the load of our long-range conventional capabilities until at least the turn of this century.

The bright spot on the horizon is the production decision on the new multirole bomber, the B-1B. The B-1B will have a conventional load-carrying capability and an excellent unrefueled range. The B-1B is being procured primarily as a nuclear penetrator for use in the single integrated operational plan (SIOP), but the B-1B will have a most important conventional role for many years to come.<sup>4</sup> Little is known about the new advanced technology bomber (ATB), but it could also have residual conventional capabilities. This aircraft will not achieve an initial operating capability (IOC) until the 1990s, so we will confine our discussion to the "rubber on the ramp," the B-52G, B-52H, and B-1B. Both the B-52 and the B-1B qualify as LRCAs. But how effective are they? The adage "only as good as the munitions they carry" will be more applicable in the future than it is today. Unfortunately, the general purpose or conventional bombs that are currently certified on the B-52, and planned for the B-1B, are the same types that were carried by our B-17s, B-24s, and B-29s during World War II and Korea.

Almost 40 years have passed and we have seen significant improvements to aircraft but minimal growth in the effectiveness of gravity-dropped weapons. The Joint Munitions Effectiveness Manual (JMEM) documents very well the limited effectiveness of the general purpose bomb. This manual predicts the number of weapons required to achieve a desired probability of destruction on a target. In many cases the requirement for a high number of general purpose bombs demands more sorties than are reasonable. An example from history might serve our purpose here. The now famous Thanh Hoa bridge of the Vietnam conflict comes to mind. Fighter aircraft flew 873 sorties, lost 11 aircraft, dropped over 2 kilotons of conventional bombs, and the bridge was still

standing and in operation. There had to be a better answer and there was. By utilizing a new technology weapon, the laser-guided bomb, this same bridge was destroyed by eight aircraft on a single mission with no aircraft losses.<sup>5</sup>

The combination of electronics and technology, electrotechnology, made a significant difference in our war-fighting capabilities. The Vietnam era introduced electrotechnology to warfare in the modern sense, but it was just the first step of this infant giant. Further development of the electronics technology base of the United States is as important to our defense today as was the atom bomb in World War II.<sup>6</sup>

Technology and war go hand in hand. If current technological progress is an example of what is coming, then it is easy to state that technology in future conflicts will play a very important role. Before investigating weapons and weapons technology appropriate to meet the threat and fulfill the roles and missions envisioned for the manned bomber force, it may be instructive to consider one more lesson from a recent conflict. The following excerpt by Ellis Rubinstein, editor of IEEE Spectrum, the journal for the Institute of Electronic and Electrical Engineers, provides the example:

At about 10 a.m. last May 4 (1982), the HMS Sheffield, a British destroyer cruising off the Falkland Islands with 262 sailors aboard, took an Argentine missile amidships and burst into flames. Twenty young men died, and with them died the myth that a big power could emerge unscathed from a head-to-head conflict with a second-rate military power.

As the world was soon to learn, Argentina, though ultimately no match for the Royal Navy, had equipped itself with a handful of French-made Exocet missiles and some French Super-Entendard jets, from which the pilots could fire the Exocet and guide it toward a target until the missile's own radar could take over.

Many of the keys to victory in warfare today are electronic: radars, lasers, computerized command-and-control systems, and so on. These technologies can produce surprise winners and losers. . . .

. . . The Sheffield sinking illustrates both how warfare is changing because of modern technology and how modern technology can produce unexpected results. The British lost a battle because of a technological vulnerability. . . .<sup>7</sup>

There can be little doubt that advanced technology will play a decisive role in future battles. Nowhere is technology more apparent than in today's sophisticated aircraft and weapons. The decisions on which aircraft to employ or what weapons to buy will likely be a result of careful evaluations of the threat, the aircraft's range of capability, variety of systems faced, force levels, and the cost-effectiveness of the aircraft, weapons, and tactics applied to the problem. This chapter discusses the threat and the available technologies that will enable strategic aircraft to contribute measurably toward meeting

mission requirements. The discussion is not intended to be a definitive, final assessment. Rather, it is intended as a framework to guide future efforts in making more detailed, definitive analyses. Here is one final thought before we consider technology requirements in more detail. In the words of the Italian airpower strategist Giulio Douhet, "Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur."<sup>8</sup>

### Soviet Defense Threat

Over the last decade the Soviets have succeeded in developing and deploying an enormous and formidable array of air defense systems. Simultaneously, Air Force conventional weapons and munitions have been inadequately funded. This has created a severe imbalance and has affected the capability of the US Air Force to carry out its tactical mission of delivering ordnance against ground targets.<sup>9</sup> The Soviet air defense threat is so formidable that eminent scientists and engineers comprising the USAF Scientific Advisory Board concluded:

It is no exaggeration to say that direct overflight of an area at altitudes within the envelope of the heavy air defenses accompanying the Soviet Union/Warsaw Pact ground forces has been rendered infeasible owing to the high attrition rates expected.<sup>10</sup>

The primary threat to Air Force aircraft considered in this chapter will be those ground-based air defense units of the Soviet ground forces and homeland air defense forces. Warsaw Pact forces will be considered coequal with Soviet capabilities, since the current trend is integration of the Warsaw Pact forces using common equipment and logistic support and forming a unified order of battle.<sup>11</sup>

The main equipment of the air defense troops of the Soviet ground forces consists of antiaircraft artillery (AAA) and surface-to-air missiles (SAMs). These weapons include the 23-mm quadruple self-propelled anti-aircraft (SPAA) gun ZSU 23-4; 57-mm twin SPAA gun ZSU 57-2; SA-7 (Grail) man portable, shoulder-launched IR SAM; SA-8 (Gecko); and SA-9 (Gaskin).<sup>12</sup> National air defense forces (PVO Strany) consist mainly of electronic warfare/ground control intercept (EW/GCI) radars, strategic SAMs, and interceptor forces. To limit the scope of this study, EW/GCI radars and interceptors will not be discussed.

About 10,000 SAMs are deployed along the borders of the Soviet Union and in selected areas around major sites.<sup>13</sup> All Soviet SAMs, except the SA-1 and SA-5, are self-propelled or transportable and are adaptable to either the strategic defense or tactical defense missions.<sup>14</sup> PVO Strany SAMs include SA-2 (Guild), SA-3 (Goa), SA-4 (Ganef), SA-5 (Gammon), SA-6 (Gainful), and the SA-10.<sup>15</sup> (See Figures 5-1 and 5-2 for detailed information on capabilities and range of Soviet SAMs). The synergistic effects of Soviet SAM defenses present a potent

threat to aircraft of all types. For the interested reader, expanded information on Soviet land-based SAMs is provided in Appendix A.

### Soviet Ship-launched SAMs

In addition to those tactical and strategic SAM systems found with the Soviet and Warsaw Pact ground forces, Soviet ships employ similar defensive missile systems.<sup>16</sup> SA-N-1 (Goa), SA-N-2 (Guideline), SA-N-3 (Goblet), and SA-N-4 (Ganef) have been seen on Soviet cruisers and destroyers as well as on Kiev and Kara class ships.<sup>17</sup> Surface ships are likely targets for bombers with an offensive maritime mission.

The Soviets have had a strong, ongoing research and development effort in surface-to-air missiles since the 1950s.<sup>18</sup> It is reasonable to expect that a new generation of SAMs is under development and that these systems will replace or complement existing systems. In any event, the SAM threat is extensive and formidable. All altitudes are covered from treetop level up to 100,000 feet and higher and from point-blank range out to 185 nautical miles and more.

### Survivability and Weapons Effectiveness

Aircraft survival in such a dense threat environment becomes questionable, particularly if such defenses must be transited, either en route or in the terminal target area. Many tactical and technological innovations assist US aircraft in overcoming these defenses--high speed, low-altitude maneuvering flight, cover of terrain or darkness, electronic countermeasures and decoys, and active defense suppression. However, it can be easily seen that possessing air-to-surface weapons of sufficient standoff range can allow an aircraft to launch its weapons outside the lethal envelope of the defenses, avoiding the ground-based defense survivability problem entirely. Standoff weapons of the kind necessary to overcome the threat will be discussed later in the chapter.

Despite the severity of the Soviet air defense threat, strategic bombers will play a major role in future conventional conflicts. This is true because of the range and payload flexibility inherent in the strategic bomber. The statement is in accordance with an official Air Force study:

The extended combat radius and large payload of the strategic bomber force can provide the theater commander with a unique weapon system. Bombers can also provide extended maritime support. . . . The Air Force should strive for a bomber force of sufficient size and flexibility to provide for the theater support role.<sup>19</sup>

FIGURE 5-1. Soviet Surface-to-Air Missiles (SAMs)\*

Designation	NATO Name	Propulsion	Approximate Speed (Mach)	Mobile = M Fixed site = FS Ship = S	Guidance	Effective (est) Altitude (ft) Maximum Minimum	Approximate Range (NM)	REMARKS
SA-1	Guild	Solid	--	FS	--	Medium	31	Antique-phase out
SA-2	Guideline	Liquid-solid	3.5	FS	Radio-radar term homer	82,000 1,000	28	
SA-3	Goa	2-stage Solid	2	M	Radio-radar term homer	49,200 150	22	Complements SA-2
SA-4	Ganef	Ramjet-solid	2.5	M	Radio-radar term	80,000	43	
SA-5	Gammon	2-Stage Solid	3.5	FS	Semiactive radar	95,000	185	Highly capable system
SA-6	Gainful	Solid rocket ramjet	2.8	M	Radio-semi-act radar	59,000	19	Excellent performance massive exports
SA-7	Grail	Solid	1.5	M	Infra-red (also laser)	5,000	2.2	Upgraded version: ceiling 14,000, shoulder-fired
SA-8	Gecko	Solid	2	M	Command-radar term	32,800	2-8	Total acquisition and fire control on single unit
SA-9	Gaskin	Solid	--	M	Infra-red	16,400	4.4	Amphibious vehicle

FIGURE 5-1. Soviet Surface-to-Air Missiles (SAMs)\* (Continued)

Designation	NATO Name	Propulsion	Approximate Speed (Mach)	Mobile = M Fixed Site = FS Ship = S	Guidance	Effective (est) Altitude (ft) Maximum Minimum	Approximate Range (NM)	REMARKS
SA-10	TBD	Rocket	6	FS/M	Radar-radar term	16,500 1,000	60	Mobile capability under development, anti-ALCM
SA-11	TBD	--	3	M	Radar	46,000 100	17	Deployed with SA-6
SA-13	TBD	Solid	--	M	IR	32,000 165	5	Replaces SA-9
SA-N-1	Goa	2-stage Solid	2	S	Radio-radar term homer	49,200	22	SA-3 variant
SA-N-2	Guideline	Liquid-solid	3.5	S	Radio-radar term homer	82,000	28	SA-2 variant
SA-N-3	Goblet	Solid-ramjet	--	S	Command-radar	82,000	18.6	Possible anti-ship capability. Upgraded range-34 NM
SA-N-4	TBD	Solid	2	S	Command-radar	--	Close-in defense	Similar to SA-8 (Little data available)
SA-N-5	TBD	--	--	S	--	--	--	Uses SA-7 missile variant

FIGURE 5-1. Soviet Surface-to-Air Missiles (SAMs)\* (Continued)

Designation	NATO Name	Propulsion	Approximate Speed (Mach)	Mobile = M Fixed Site = FS Ship = S	Guidance	Effective (est) Altitude (ft) Maximum Minimum	Approximate Range (NM)	REMARKS
SA-N-6	TBD	--	6	S	Sophisticated	100,000	37	ECCM capabilities (Little data available)
SA-N-7	TBD	--	--	S	Radar	--	--	SA-11 variant (Little data available)

\*Source: The World's Missile Systems, April 1982, 7th ed., Pomona Division-General Dynamics, Air Force Magazine, March 1983, pp. 93-94, plus other miscellaneous unclassified documents.  
Data is nominal averages of all sources.

# SOVIET SAM ENVELOPE (ESTIMATED)

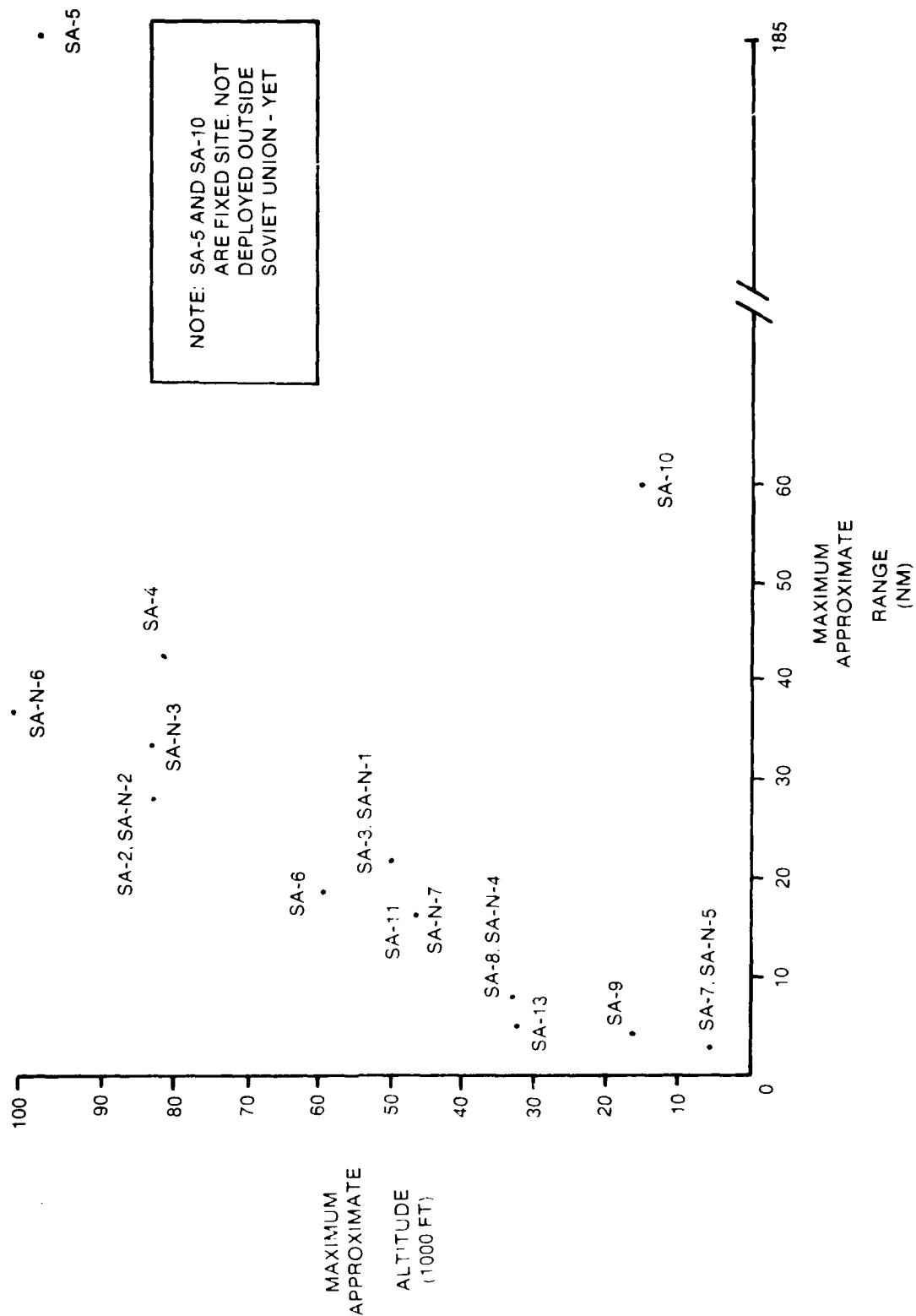


FIGURE 5-2



The concept of aircraft range cannot be overemphasized. Range is fundamental to the projection of military power. It enables a response to diverse regions of the world when timely intervention is necessary and other forces or required support infrastructure are unavailable.<sup>20</sup> But range and mobility are irrelevant without effective weapons or the ability to survive the attack.

The bomber's current capability is limited to the carriage of gravity bombs of World War II vintage and aerial-delivered naval mines. Weapon inventories available and certified for bomber carriage consist mainly of MK 82, MK 84, and M-117 iron bombs and the MK 36, MK 52, MK 55, MK 56, and MK 60 naval mines. Delivery of these munitions requires direct target overflight at either high or low altitude. The associated attrition rates for target overflight depend on many factors, including target and weapon system allocation and employment tactics. However, it is a trivial numerical exercise to calculate that even with attrition rates as low as two to five percent per sortie, only a short time is required before the bomber force is unacceptably decimated. The USAF Scientific Advisory Board observed:

The uncertainty as to the reduction of attrition gained under current doctrine (allocation and tactics) underlines the necessity to provide operational commanders with weapons allowing wider options in attrition management. Such weapons include those making it unnecessary to "pop up," those achieving multiple kills on a single pass, and those with standoff range.<sup>21</sup>

In addition to the survivability problem, there is also the question of weapon effectiveness. Most of the gravity bombs require very steep impact angles for maximum effect. Shallow angles, such as those achieved by low-altitude delivery of unretarded weapons, tend to make the munitions' blast ineffective. Precise data on this problem can be obtained by referring to the Joint Munitions Effectiveness Manual. Fuzing and case breakup (with delayed charges) are also problems. Perhaps most important of all is that unguided weapons, even if they are employed and then function correctly, are relatively ineffective because even a small aiming error greatly reduces their destructive force. Again the USAF Scientific Advisory Board observed, "The MK 80 series of gravity general purpose bombs do not meet the requirements of the most efficient and effective weapons possible."<sup>22</sup>

The point is this: We can no longer afford to waste munitions, aircraft, and lives when technology exists that can enhance the survivability and the capability of our force many times over. In the words of Norman R. Augustine, vice president of Martin Marietta Corporation, former Under Secretary of the Army and current chairman of the Defense Science Board (DSB):

Throughout aviation history, the lack of truly capable air-delivered conventional ordnance in large quantities has represented a major

limitation on the effectiveness of tactical airpower. Recent developments in electronics and optics now provide the opportunity to convert this liability into an asset--the scale of which could be equivalent in air-to-ground operations to acquiring one more entire US Air Force and a dozen carrier battle groups.<sup>23</sup>

The advent of modern, effective munitions holds the promise of correcting the deficiencies and overcoming the threat. However, whenever precision-guided munitions, "smart" bombs, or standoff missiles are proposed, the discussion inevitably leads to concerns over costs. Highly simplified, the argument against such weapons usually revolves around the claim of being so expensive on a per round basis that we will only be able to afford a few of them, an amount that would likely be expended in a few days at most leaving our combat forces without weapons to sustain an extended battle.

Sophisticated, "smart" standoff weapons unquestionably cost more than "dumb" iron bombs. But they cannot be compared on a munition by munition basis, because the effectiveness of a given weapon enhances the probability of success in the chain of events that lead to target destruction, including the costs of recruiting, training, equipping, deploying, supplying, and employing the force. All these costs are ultimately wasted efforts unless the weapon(s) hits and destroys its intended target.<sup>24</sup> When the factor of aircraft or aircrew attrition is addressed, the overall costs of doing business with ineffective weapons become enormous. For example, the expectation of missing the target with ineffective weapons is illustrated by the data from the war in Vietnam. During the siege at Khe Sanh, over 24,000 tactical strike sorties and 2,500 B-52 sorties were flown in 69 days, the ordnance delivered equating to a density of 0.25 pounds per square foot or approximately 7 to 8 tons per target destroyed.<sup>25</sup> A previous quote of Norman R. Augustine is stated here to emphasize the principal of leverage.

Clearly, the solution is not to be found in delivering more ordnance. The leverage is in finding and hitting the target . . . functions which technological advancements of the past decade now make generally attainable through modern surveillance, command and control, weapon delivery, and guidance.<sup>26</sup>

To support this observation, Augustine describes a simple, parametric cost model developed by James B. Morrison, Richard F. Harris, and himself (all of Martin Marietta Aerospace) that assesses the more important trade-offs between ordnance effectiveness and total force effectiveness. The conclusions of the analysis are unmistakable. Presuming that existing weapon inventories represent sunk costs, and therefore these weapons are "free" in the analysis, then a standoff "smart" weapon that had only a 50-50 chance of hitting the target would still be twice as cost effective as the equivalent attack using iron bombs.<sup>27</sup> When mission costs are considered, obviously total costs must be compared, not just munition versus munition. In addition to superior cost-

effectiveness, precision-guided munitions offer the opportunity to reduce the individual destructive power of the weapons to the minimum necessary, thereby permitting greater economies of force.<sup>28</sup> A recent study provides the bottom line: By improving standoff weapons, all-weather systems, specialized munitions, and real-time target location methods, technology will magnify the destruction that airpower can deliver on enemy forces.<sup>29</sup>

Before turning to an examination of appropriate systems and technologies that can enhance the conventional capabilities of the strategic bomber, we need to develop some ground rules and a framework for that examination.

First, because of the dual role (nuclear and conventional) SAC bombers are likely to maintain for the foreseeable future, SAC requirements should reflect Air Force needs; unique requirements should be kept to a minimum.<sup>30</sup> Interoperability with the weapons of tactical aircraft, to the extent feasible, will permit SAC bombers to function conventionally, worldwide, with a minimum requirement for individual provisioning and munition logistic support. Second, Air Force war-fighting capability in the future may be seriously restricted by our (present) deficiencies in both the quality and quantity of conventional munitions.<sup>31</sup> Therefore, weapon requirements should be framed on the basis of cost, utility, effectiveness, and aircraft survivability.<sup>32</sup> Also, no one munition should be used exclusively over time. Heavy defenses during the early stages of conflict may require a predominant utilization of new technology weapons with standoff range and multiple kills per sortie. When the targets have been reduced and defenses worn down, existing mature technology weapons may be useful and may provide the bulk of sustained capabilities.<sup>33</sup>

Another dimension of a realistic framework is time. Adaptation of existing weapons and systems can be accomplished in a relatively short time. The development of a new, sophisticated long-range standoff missile, for example, will take several years. The order of presentation in the next section will follow the general construct of existing or mature weapon systems readily adaptable to the mission; near-term systems (those currently in full scale development or ready to enter production); and far-term options (those either in conceptual or advanced development stages). Obviously, the implementation of any of these three options can be impacted by the emphasis and funding support provided. However, the existing, near-term, and far-term construct will suffice to organize our thoughts along practical lines.

Finally, the missions and roles that the conventionally armed bomber might be called on to fulfill will affect which systems are examined and which are not. For instance, the bomber will not be a likely candidate as an air defense interceptor; therefore offensive air-to-air missiles will not be examined. The mission types chosen represent general categories of high-value interdiction targets: including ships, airfields, soft area targets, and hard, fixed targets. Area

mining, land and naval, will also be considered. Other missions may be feasible. However, only those missions for which current or planned weapons are in development will be accounted for in this section.

The above approach of filtering the myriad weapon system possibilities is consistent with official Air Force thinking. The USAF Scientific Advisory Board identifies the four major missions of tactical airpower as air defense suppression, airfield attack, battlefield maneuver units, and hard targets.<sup>34</sup> These general categories are reaffirmed by the development personnel of the Air Force Systems Command.<sup>35</sup>

To insure that our search for appropriate weapons technology is on the right track, we quote from the introductory remarks of the USAF Scientific Advisory Board's 1981 summer study on nonnuclear armaments:

It has become increasingly evident that only a critical examination, selection and vigorous development of pertinent weapons technologies in the light of requisite tactical air capabilities can hope to provide a realistic and effective solution. . . . To maximize target kill rate with minimal attrition, the low altitude penetration capability must be coupled with engagement systems and weapons/munitions that provide multiple kills per pass--with no pop-up or re-attack required. The other conceivable corrective measures--to suppress/roll back enemy air defenses to permit penetration or avoid altogether the necessity of penetration although the use of standoff weapons--both require the development of appropriate weapon systems.<sup>36</sup>

#### Existing Weapon Options

Existing or production base weapons are those currently in the inventory or in production and generally consist of direct attack or short-range standoff weapons of 1950 to 1960 vintage technologies. Examples are the general purpose iron bombs, cluster bombs, naval mines, and weapons of the glide bomb unit family (GBU 10, 12).<sup>37</sup>

#### GBU-10/12

The GBU-10/12, in the existing inventory, are laser-guided bombs (LGBs) with unitary warheads. Adapter kits are available to convert the MK 82 and MK 84 general purpose bombs into gravity-released gliding munitions with laser seekers and a simple auto pilot for control.<sup>38</sup> Although the laser guidance still requires target exposure for employment, it drastically improves weapon accuracy and greatly reduces the number of weapons and sorties required to destroy a given target. The laser target designator can be carried by the attacking aircraft or a second "spotter" plane, or even by a ground-based laser illuminator. In a permissive air defense environment, the LGB family of weapons is

very effective against fixed targets of all types. Another attractive feature of this weapon is that through the use of the relatively simple conversion kit, the vast quantities of inventory MK 82 and MK 84 bombs can be used to good advantage. Feasibility of carrying the GBU-10 on B-52 aircraft was demonstrated by the Air Force Armament Development and Test Center in 1975.<sup>39</sup> Carriage of the GBU-10 and -12, as well as any number of other laser-guided gravity weapons, is essentially a question of carriage certification rather than aircraft modification. Such other laser-guided free-fall weapons as MK 20 Rockeye (KMU-420/B), M117 (KMU-302/B), and Pave Storm (KMU-421/B) are possible bomber-suitable munitions.<sup>40</sup>

#### Chemical Bomb

Bomb live unit, BLU-80 Bigeye, is a chemical weapon currently certified on the B-52.<sup>41</sup> Certification of the MC-1 750-pound nonpersistent gas bomb and the MK 94 500-pound nonpersistent gas bomb should also be undertaken.<sup>42</sup> These weapons are the few air deliverable chemical weapons in the US inventory, and they should be retained as a deterrent capability until such time as more modern weapons, such as those integrating the binary chemical concept, are developed.

#### Airfield Attack Weapon

The Durandal penetration bomb is a French designed weapon used for disablement of airfields by low-level bombing attacks. It uses a retardation parachute to enable delivery and then employs a rocket motor that accelerates the weapon to a high penetration velocity at the proper impact angle. The weapon detonates under the runway surface, creating a crater and a damaged area of about 200 square meters. Durandal has been in production since 1975 and would require only procurement and certification for use by US forces.<sup>43</sup>

#### Other Free-fall Weapons (Land)

Existing stocks of free-fall weapons should be deployed on bombers for use in less intense air defense environments and for sustaining combat capability when the supplies of newer weapons are exhausted or are unavailable. Included in this category are the MK 82 500-pound general purpose (GP) bomb, MK 84 2,000-pound GP bomb, M117 750-pound GP bomb, MK 20 Rockeye, MK 82 Mod 1 Snakeye, and MK 36 Destructor (land mine).<sup>44</sup> Retention of these older "dumb" bombs not only would enhance sustainability in an extended conflict but would also provide a hedge against unforeseen failures of advanced weapon development or program delays.

## Sea Mines

SAC bombers currently support the collateral naval mission of aerial mine-laying.<sup>45</sup> To retain and enhance this capability, SAC bombers should carry the following sea mines (bottom mines or moored mines): M117/MK 36 Destructor 1,000-pound mine, MK 52 1,000-pound mine, MK 55 2,000-pound mine, MK 56 2,000-pound mine, and the MK 60 Captor 2,000-pound mine.<sup>46</sup> The newer quick strike series of naval mines require only carriage certification for employment or deployment and should be pursued to complement the Navy's mine-laying requirements. The quick strike (QS) series include the QS-MK 62 500-pound mine, QS-MK 63 1,000-pound mine, QS-MK 64 2,000-pound mine, and the QS-MK 65 2,000-pound mine.<sup>47</sup>

## Near-term Weapon Options

Near-term weapons are those weapons and technologies that are currently in full scale development or ready for initial production. They generally represent technology of the 1970s and for the most part are shorter range and express single kill per weapon concepts.<sup>48</sup> Some existing weapons have been included in the near-term category because of the additional development work necessary to adapt these systems to the bomber--a task that may require substantial time and money for the more sophisticated systems.

## Harpoon

AGM-84 Harpoon is an all-weather antiship missile developed for the US Navy and in various configurations can be launched from aircraft, ships, or submarines.<sup>49</sup> The missile entered service with the Navy in 1977, but is included as a near-term option because of the more extensive development and modification effort that would be required to adapt the system to the B-52 or B-1B. Harpoon uses a turbojet engine for propulsion and relies upon target position and velocity inputs from the launching aircraft for initialization. The missile flies toward the target at sea-skimming altitudes in the high-subsonic speed range. An active radar seeker provides terminal guidance. The warhead is a high explosive blast device utilizing a time delay contact fuze to enable penetration of the target ship's hull. The missile is about 12 feet long, weighs about 1,200 pounds, and has a maximum air-launched range of about 100 nautical miles.<sup>50</sup> The Exocet missile, used so successfully in the Falklands, is similar to the Harpoon in performance characteristics, though less sophisticated and much shorter in range.<sup>51</sup> An existing and highly capable missile, such as the Harpoon, coupled to the extended range and all-weather ocean search capability of the B-52 or B-1B would provide a worldwide sea-lane control and interdiction capability. An improved version of the Harpoon, such as an imaging infrared (IIR) version, would greatly enhance the flexibility of such a system. A memorandum of agreement (MOA) entitled "Joint USN/USAF Efforts for

Enhancement of Joint Operations," released by the Department of Defense on 30 November 1982, establishes an official basis for developing a capability of this type.<sup>52</sup>

#### Tactical Munitions Dispenser

The tactical munitions dispenser (TMD) program is developing a new bomblet dispensing canister for the next generation of cluster bombs. The new SUU-64/65 canister will replace the older cluster bomb unit (CBU) dispensers and will enable safer and more efficient munition delivery at a variety of speeds and altitudes. The combined effects munition (CBU-87/B) uses the SUU-65/A dispenser and the combined effects bomblet (BLU-97/B) to provide a next generation general purpose cluster munition. It has both antimaterial and antiarmor kill mechanisms and is expected to eventually replace the older CBU-52/58/71 and MK 20 Rockeye munitions.<sup>53</sup> The SUU-64 and Gator mine bomblet combine to form the CBU-89. Submunitions consist of the BLU-91/B and BLU-92/B bomblets. The Gator mine system will provide the first real capability for antiarmor/antipersonnel area denial<sup>54</sup> and will aid in disrupting airfield operations and will reduce enemy sortie generation capability.<sup>55</sup>

#### New Fuze Mechanisms

Apart from the need to overfly the target when using gravity weapons, one of the major problems associated with existing general purpose bombs is the failure rate of the older fuze combinations. Several new fuze designs are ready to enter production. These newer fuzes will revitalize the effectiveness of our current stockpile of general purpose bombs. The FMU-130 fuze will replace the older M904 and M905 combination and significantly improve the reliability and effectiveness of high-altitude, subsonic delivery of "slick" (unretarded) bombs. The FMU-113 fuze will provide a much needed proximity burst (about 15 feet above ground) for high-altitude bomb delivery. Finally, the new FMU-139 fuze will provide a new capability for proximity bursts of low-altitude, high-drag release of weapons such as the MK 82 Mod 1 Snakeye.<sup>56</sup>

#### Maverick

The AGM-65 Maverick series (-65A/B/C/D/E/F) are solid propellant rocket missiles with shaped-charge, unitary warheads designed for use by tactical fighter aircraft against hard or discrete ground targets. These missiles differ from one another by the type of guidance system employed (TV, laser, infrared, imaging infrared, etc.). The missiles provide a standoff range of 10 to 12 miles and should be survivable after launch because of supersonic speed.<sup>57</sup> The missile could be used against ships, tanks, bunkered targets, radar sites, and so on. The Maverick would be useful only if appropriate target acquisition seekers were used on the bomber, or if used with an accompanying illuminator

aircraft equipped with the Lantern pod system. The weapon is included here because the Air Force plans to purchase a large inventory of these missiles, and they could be very effective in an appropriate threat environment.<sup>58</sup>

#### HARM

The AGM-88A, a high-speed antiradiation missile (HARM), is designed for use against enemy radars. Defense suppression is not one of the primary mission categories being considered for bombers, but the AGM-88A is included as representative of available standoff missile technology. Such a capability could be very useful for bomber defense in a rapid deployment force scenario. HARM weighs about 800 pounds, is 14 feet long, and is powered at supersonic speed by a two-stage solid rocket motor. It is guided by a passive radar seeker. The high-explosive warhead is fuzed by a laser ranger/seeker or by guidance calculations.<sup>59</sup> As in the case of the Maverick, the major drawback of HARM would be the technical difficulty of integrating the system into the bomber and the need for specialized target acquisition equipment. However, as with the Maverick, a large inventory of HARM is planned.

#### Far-term Weapon Options

Far-term or new technology weapons are those currently in conceptual or validation stages of development. These weapons represent technology of the 1980s and will generally be medium to long range, launch and leave weapons effecting multiple kills per sortie. Because of their technological sophistication, these far-term weapons will likely be higher in cost and therefore be procured in smaller quantities.<sup>60</sup> The precise description of these new, conceptual, or advanced development systems may differ ultimately from the final system or systems that may be produced. This problem is not extremely important, however, in the present discussion. These new technologies are more important for the concepts (long-range, "smart" standoff weapons) they embody rather than for the particular engineering designs they represent.

#### MRASM

The medium-range air-to-surface missile (MRASM) is a conventionally armed cruise missile based upon the nuclear cruise missile technology (AGM-109 series of the General Dynamics Corporation) and the Navy's antiship Tomahawk program.<sup>61</sup> The missile is about 16 to 20 feet long, 20 inches in diameter, and weighs between 2,200 and 3,100 pounds depending upon the configuration. The system employs a Teledyne turbojet engine and uses terrain-contour-matching (TERCOM) and scene-matching-area correlator (SMAC) systems for enroute and terminal guidance. Missile speed is variable but can reach about 550 mph at



sea-skimming or terrain-contour-flight altitudes.<sup>62</sup> The MRASM is modular in design and can carry either unitary warheads or clusters of submunitions in the weapon's bay. The reality of MRASM technology has been demonstrated. Dr. Kenneth P. Werrell, writing on cruise missile technology, relates the demonstration test flight of MRASM:

In May 1978, a modified Tomahawk flew 403 miles from its launch point to the Dugway Proving Ground guided by TERCOM and with scene matching area correlator (SMAC) terminal guidance, and dropped 11 of its 12 bomblets dead on its runway target. It then returned over the target simulating a photo reconnaissance run.<sup>63</sup>

However, the biggest technological hurdle to be overcome is munition or submunition.<sup>64</sup> A number of submunitions has been investigated. Individual candidate submunitions will be discussed later, but it is sufficient to note that MRASM can carry a 1,000-pound class warhead, enough payload to accommodate several hundred individual bomblets or a unitary high explosive warhead. Although MRASM promises an extremely effective multiple kill per pass or multiple kill per sortie standoff capability, its per unit cost will be high. Estimates cover a wide range, but development of the system may cost \$6 billion with a per unit cost in the \$1 million category.<sup>65</sup> However, it must be remembered that high-per-unit cost is not so important as the overall cost for mission completion. The usefulness of MRASM deployed on a manned bomber seems obvious--long-range standoff attack of high priority or fixed targets (airfields and ships), taking advantage of the bomber's range and payload to provide flexibility in employment concepts. In addition, the similarities to the established mission of the nuclear warhead, air-launched cruise missile make MRASM a "natural" complement to the strategic bomber.

#### SAW

The standoff attack weapon (SAW) is another new concept in the standoff weapon competition. It is described by Dr. Joseph Maycrsak, a technical director in the Air Force's Armament Division, as a powered, dispenser weapon in the 2,000-pound class, using demonstrated technology.<sup>66</sup> SAW is described by Air Force Systems Command as a "smart" dispenser-based weapon, capable of a 15 to 20 kilometer range, configured with cratering submunitions, antiarmor and antipersonnel submunitions, or area-denial mines.<sup>67</sup> Whatever the final technical description of SAW is, the concept will provide a spectrum of tactical aircraft with a low-cost, flexible weapon capable of carrying a wide variety of payloads that can be employed from low altitude at sufficient range to avoid most high-threat terminal defenses.<sup>68</sup> The major differences between SAW and MRASM appear to be SAW's lower per-unit cost and earlier availability, constrained performance for simplicity, less terminal accuracy required, and smaller size and weight for tactical aircraft compatibility. Both weapons would carry the same type of submunitions.<sup>69</sup> SAW is envisioned as a large inventory, war-sustaining

weapon and as such should be considered for bomber carriage in any complete weapon suitability analysis.

### JTACMS

The concept of the joint tactical missile system (JTACMS), previously known as the conventional standoff weapon (CSW), is envisioned as a medium-range missile (50 to 100 miles) launched from either air- or ground-based systems against fixed or mobile targets. The concept was developed by the Defense Advanced Research Project Agency under its Assault Breaker program. Used in conjunction with appropriate radar tracking, targeting, and guidance systems, the JTACMS will provide Air Force and Army units with a conventional means of attacking targets that previously could only be dealt with effectively by nuclear weapons.<sup>70</sup> The system's feasibility has been successfully demonstrated during the Assault Breaker program, using a modified variant of the Army's Patriot missile. Such a weapon system would fill the gap between the low-cost, short-range performance of SAW and the high-cost, sophisticated, long-range performance offered by MRASM. The suitability of SAC bombers in the JTACMS concept is similar to the MRASM case. Early program estimates include the B-52 and B-1B as likely carrier aircraft.<sup>71</sup>

### Submunitions

A variety of submunition concepts are being investigated, principally by the Air Force's Armament Division at Eglin AFB, Florida. The Air Force development and procurement community recognizes that the requirement for high-weapon effectiveness and multiple kills per weapon will necessitate the use of "smart," sensor-fuzed submunitions.<sup>72</sup>

It is absolutely critical to the success of a standoff weapon's concept to develop and perfect "smart" submunitions. The following is a candidate list of possible submunitions for MRASM, SAW, and JTCMS use. Technical details have been purposely avoided because of the classified nature of the sensor-fuzing and guidance elements.<sup>73</sup>

STABO. West German-developed, dual-stage runway cratering submunition.

SG 357. United Kingdom, dual-stage runway cratering submunition.

BKEP. Boosted kinetic energy penetrator, a US-developed runway cratering submunition. BKEP is a leading candidate in the MRASM anti-airfield attack mission.

Gator. The BLU-91 antiarmor and BLU-92 antipersonnel bomblets in combination. Gator is available today, but has not been integrated for Air Force use into a dispensing system other than the tactical munitions dispenser (SUU-64).

ERAM. Extended-range antiarmor mine, a US development program intended as a direct or indirect antitank mine. ERAM uses multiple sensors and multiple shots per mine to effect a kill from points some distance from the tank's path.

SKEET. Part of the ERAM system, SKEET is a forged fragment, sensor-fuzed antiarmor submunition.

PADS. Programmable area denial system, a conceptual combination of contact and sensor-fuzed mines and bomblets primarily to disrupt airfield operations and impede cleanup operations.

HB-876. An airfield denial mine developed by the United Kingdom as a part of the JP-233 airfield attack system.

CEB. Combined effects bomblet (BLU-97), a US-developed light armor and antipersonnel/material submunition.

AMIS. Antimaterial incendiary submunition, a US-developed antimaterial bomblet possessing superior diesel fire-starting characteristics.

M-74. A US Army-developed bomb live unit with an improved, lighter, tungsten steel case providing much greater destructive power per bomblet.

SADARM. US Army-developed, sensor-fuzed, forged-fragment submunition, activated in a top-firing position after submunition deployment.

TGSM. Terminally guided missile developed by General Dynamics, using "smart" terminal guidance, sensor-fuzing, and a forged-fragment kill mechanism.

#### MIL STD 1760 Modification

Military standard (MIL STD) 1760 is a new technical specification to which all future Air Force weapons and aircraft will be built. The new MIL STD defines the mechanical, electrical, and electronic control interfaces between aircraft and the weapons they carry. It is intended to minimize the requirements for adapting new weapons to new aircraft and to facilitate mission flexibility in a wartime environment with a minimum of support requirements. A technical problem arises in that most of the new weapons or weapon systems suggested in this paper will incorporate MIL STD 1760, but MIL STD 1760 is not incorporated in the older B-52.

A preliminary evaluation of the impact of converting a B-52 to MIL STD 1760 requirements was conducted by the Martin Marietta

Corporation in conjunction with the Assault Breaker concept demonstration program. For external carriage of a MIL STD 1760 missile, it was estimated that mechanical impact would be nil, since MIL STD 1760 is compatible with the existing MAU-12 weapon release racks. Electrical interfaces would require either a new missile interface unit (MIU) or unique adapter wiring. Electronic information would require installing a MIL STD 1553B data bus or a unique electronic-stores-interface adapter and existing software. Control and display units would be modified to handle an increase of 500 to 2,000 "words" plus changes in the avionics processor and the associated controls and displays.<sup>74</sup>

#### Common Bomber Weapons Launcher

Another missile compatibility problem centers on internal carriage of weapons requiring extensive monitor, control, and environmental functions. The Air Force has recognized this problem and plans to obtain a multipurpose common strategic rotary launcher (CSRL) for the B-52, B-1B, and the advanced technology bomber.<sup>75</sup> Such a system would enable any bomber to carry internally a variety of weapons, provided that the launcher is built to MIL STD 1760 interface requirements. It is not apparent if current CSRL plans include MIL STD 1760 requirements; but it is obvious that if the new conventional weapons are to be carried internally, then any new launcher should be compatible with those weapons.

#### Summary

The foregoing survey of existing, near-term, and far-term weapon options for strategic bombers was neither a complete catalog nor a list of specific programs to be funded, developed, and deployed. It is a practical guide to the possibilities of the types of weapon systems that could significantly enhance the conventional war-making capacity of the strategic bomber force, present and future. Yet, there is another way to investigate technology and its potential benefits for mission enhancement.

This second methodology involves looking at broad technological areas, considering new developments that promise to make an impact on a wide variety of functional mission areas. This "macro" approach has been studied and written about by many knowledgeable individuals both inside and outside the Department of Defense. Dr. Richard D. Delauer, Under Secretary of Defense for Research and Engineering, recognizes this approach as a major goal for Pentagon planners. In his words:

Instead of a broad base of activity in the research and exploratory development programs with technology like a candy store where people can pick at it, we are trying to configure these areas of technology for future weapons needs.<sup>76</sup>

We can identify several broad technology programs that can make a difference in future combat operations. These programs include microelectronics (very high-speed integrated circuits, failure tolerant electronics, hardening against radiation effects), advanced software and algorithms (artificial intelligence and optical processing), rapid solidification technology, advanced composite materials, active and passive stealth technology, space-based radar, infrared arrays, and high-energy weapons.<sup>77</sup> Technological developments such as these will benefit future weapons, strategic or tactical, in the areas of missile guidance, target sensing, target recognition, and target discrimination. The Department of Defense has recognized the importance of electronics in future weapon developments and has divided its electronics research thrusts into the following related mission areas: search and surveillance, target acquisition and fire control, communications, navigation, command and control, and electronic warfare.<sup>78</sup> No attempt will be made in this section to outline the specific technological approaches in each mission area. However, a brief expansion of each mission area that relates to conventional warfare can be found in Appendix C. There is little doubt that development of military electronics technology will contribute significantly to future weapon systems.

#### Observations

The value of this study lies in the framework or architecture it suggests for establishing a conventional bomber force. Any attempt to justify specific programs requires an in-depth analysis of all alternatives and trade-offs. A complete life-cycle cost and cost-effectiveness study of any single program or group of programs would be appropriate. Because of the potential cost of these systems and the importance of providing our country with a strong, efficient defense, the necessary studies appear justified. But some limited improvements can be accomplished now and within the next three to five years. Beyond that, careful planning of actual programs initiated today may pay off in the long term, five to fifteen years from now.

The technology is in hand to solve our existing and future problems of conventional weapons. The issue is that of choosing a path through the available opportunities that will lead to real military capability. The enemy threat and the almost irreplaceable value of our bomber force demand a move toward these new "smart," highly effective weapons. The next chapter is devoted to the potential uses of the strategic bomber if these new technology weapons were acquired and employed.

## NOTES

### CHAPTER V

1. USAF Summary 1982, Director of Cost and Management Analysis, Comptroller of the Air Force, pp. 3-8.
2. "B-52s Bomb Egyptian Desert," Air Force Times, 7 December 1981, p. 38.
3. "RDF Oman Maneuvers Conducted Behind Veil of Secrecy," Alabama Journal, 6 December 1982, p. 13.
4. Caspar W. Weinberger, Annual Report to the Congress, Fiscal Year 1983 (Washington, D.C.: US Government Printing Office, 1983), p. 141.
5. Verne Orr and General Lew Allen, Jr., USAF, "The Posture of the Air Force and Budget Estimates for Fiscal Year 1983," a Department of the Air Force joint statement before committees and subcommittees of the US Senate and the House of Representatives, 2d Sess., 97th Congress, p. 29. Also Norman R. Augustine, "Brilliant Missiles on the Horizon," IEEE Spectrum 19, no. 10 (October 1982):96.
6. Richard D. Delaur, "The Force Multiplier," IEEE Spectrum 19, no. 10 (October 1982):37.
7. Edward Rubinstein, ed., "Technology in War and Peace," IEEE Spectrum 19, no. 10 (October 1982):34-35.
8. Headquarters US' , Air Force 2000, "Executive Summary" (Secret) (Washington, D.C.: Headquarters USAF, 1982), p. 1. (Note: All references to Air Force 2000 in this paper are unclassified.)
9. USAF Scientific Advisory Board Ad Hoc Committee Report on Non-Nuclear Armament, Vol. 1 (Secret) (Washington, D.C.: Headquarters USAF, 1981), p. 1. (Note: All references to the USAF SAB Ad Hoc report in this paper are unclassified.)
10. Ibid., p. 3.
11. Handbook on the Soviet Armed Forces, (Washington, D.C.: Defense Intelligence Agency, 1978), p. 1-1.
12. Ibid., pp. 8-25, 26.
13. Ibid., pp. 11-4.

14. Ibid., pp. 11-12.
15. Ibid., pp. 11-16.
16. DIA Handbook, pp. 9-23.
17. R. T. Pretty, ed., Jane's Weapon Systems 1980-81 (London: Jane's Publishing Co., Ltd., 1980), p. 101.
18. DIA Handbook, pp. 11-12.
19. Air Force 2000, "Executive Summary" (Secret) (Washington, D.C.: Headquarters USAF, 1982), p. 10. (Note: All references to Air Force 2000 in this paper are unclassified.)
20. Ibid., p. 25.
21. SAB Ad Hoc Committee Report, p. 11.
22. Ibid., p. 31.
23. Norman R. Augustine, "Air Munitions: The Missing Link?", Military Electronics/Countermeasures (April 1982):33.
24. Ibid., p. 36.
25. Ibid., pp. 36-37.
26. Ibid., p. 40.
27. Ibid., pp. 42-43.
28. R. V. Jones, "Future Conflict and New Technology," The Washington Papers, vol. IX, (Beverly Hills, Calif.: The Center for Strategic and International Studies, 1981), p. 62.
29. Air Force 2000, p. 7.
30. Avionics and Armament Division, DCS/Plans, A Conventional Weapon System Roadmap for Strategic Air Command (draft) (Secret) (Offutt AFB, Nebr.: Strategic Air Command, 1981), p. 6. (Note: All references to the SAC Conventional Roadmap in this paper are unclassified.)
31. Armament Roadmap (briefing) (Andrews AFB, Md.: Air Force Systems Command, 1982), p. 1.
32. SAC Conventional Roadmap (draft), p. 5.
33. AFSC Armament Roadmap, p. 8.

34. SAB Ad Hoc Committee Report, p. 6.
35. Conventional Air Power: Investing in Armament (briefing) (Andrews AFB, Md.: Air Force Systems Command, 1982), p. 1.
36. SAB Ad Hoc Committee Report, pp. 1, 3.
37. AFSC Armament Roadmap, p. 6.
38. SAC Conventional Roadmap (draft), p. 3.
39. G. K. Lundin, Compatibility Test of the GBU-10 (Guided Bomb) on B-52 Aircraft, ADTC-TR-75-11 (Eglin AFB, Fla.: ADTC/DLJ, 1975), p. 8.
40. Jane's Weapon Systems, p. 805.
41. Ibid., p. 802.
42. Ibid., p. 803.
43. Ibid., p. 386.
44. Ibid., pp. 802-805.
45. Ibid., p. 133.
46. Ibid., p. 803.
47. Strategic Air Command, Avionics and Armament Division, DCS/Plans, Offutt AFB, Nebr., telephone interview with author on 12 January 1983.
48. AFSC Armament Roadmap, p. 6.
49. Jane's Weapon Systems, p. 157.
50. General Dynamics Corporation, Pomona Division, The World's Missile Systems, 7th ed. (Pomona, Calif.: The General Dynamics Corp., 1982), p. 91.
51. Jane's Weapon Systems, p. 139.
52. L. Famiglietti, "AF, Navy Pact Will Boost Sea Defense," Air Force Times, 13 December 1982, p. 4.
53. AFSC Armament Roadmap, p. 17.
54. Ibid., p. 3.
55. Ibid., p. 13.



56. SAC, Avionics and Armament Division, DCS/Plans, telephone interview, 12 January 1983.
57. The World's Missile Systems, pp. 136-141.
58. AFSC Armament Roadmap, p. 18.
59. The World's Missile Systems, p. 87.
60. AFSC Armament Roadmap, p. 7.
61. Kenneth P. Werrell, "The Cruise Missile: Yesterday, Today, and Tomorrow" (Research report, Airpower Research Institute, Maxwell AFB, Ala., 1983), p. 240. (Unpublished)
62. The World's Missile Systems, p. 321.
63. Werrell, p. 241.
64. Ibid., p. 241.
65. Ibid., p. 245.
66. W. Andrews, "Standoff Weapon in 'Formulation' Stage," Air Force Times, 25 October 1982, p. 24.
67. AFSC Armament Roadmap, p. 4.
68. Tactical Air Command, HQ TAC/DR Letter, TAF 314-82 for Comment Statement of Operational Need (SON) for the Standoff Attack Weapon (SAW), Langley AFB, Va., 3 September 1982).
69. AFSC Armament Roadmap, p. 13.
70. C. Doe, "Joint 'Attack' Missile System Bids Likely," Air Force Times, 10 January 1983, p. 23.
71. The World's Missile Systems, p. 333.
72. AFSC Armament Roadmap, p. 5.
73. Ibid., pp. 21-22. (Note: All submunitions covered in this section are detailed in the AFSC Armament Roadmap briefing.)
74. Martin Marietta Corporation, Orlando Aerospace Division, Common Missile (briefing) (Secret) (Orlando, Fla.: Martin Marietta Corp., October 1982), p. 33.
75. Leonard Famiglietti, "Plan for Managing Weapons Launchers Due by Mid-January," Air Force Times, 13 December 1982, p. 22.

76. Clarence A. Robinson, Jr., "Management: DeLauer Urges Technology Spending," Aviation Week and Space Technology, 6 September 1982, p. 257.

77. Ibid., p. 259.

78. Joseph Feinstein, "Research Thrusts of the DOD," IEEE Spectrum 19, no. 10, (October 1982):91.

## CHAPTER VI

### POTENTIAL FOR THE FUTURE

In the preceeding chapters, an attempt was made to establish the thought that strategic bombers could provide a partial solution to the expanding capability of the Soviet Union to project conventional power and influence outside the confines of its borders. Many avenues were traveled in pursuing that thought. A historical perspective was needed to tie strategy and weapons together. A look at US policy, strategy, and guidance was necessary to insure that we were still headed in the right direction. The issue of improved defenses highlighted the need for management of attrition, regardless of what type of delivery aircraft was used for the attack. New technology not only benefited the defenses but also gave the offensive forces additional leverage and served as a force multiplier. Here is where a combination of a LRCA and new technology weapons was introduced as a possible "fix" for rapid force projection problems in the US Air Force. These new technology weapons can have a potent impact on the employment of airpower in the future. Dr. William J. Perry, former Under Secretary for Defense, Research, and Evaluation, said these new "smart" weapons were revolutionizing tactical warfare and would have a greater impact than the introduction of radar.<sup>1</sup> Just how great an impact will only be proven or disproven by the passage of time and events. However, in the Fiscal Year 1984 Air Force Report to the Congress, our top leaders state:

We have to stay on the frontiers of technology--our ace in the hole--and protect our advantages. Western technology can offset Soviet numerical superiority if we exploit it wisely and flexibly. At the same time, we cannot afford to let our technological advantages slip or be stolen away to be used by the Soviet Union. We cannot allow our combat capability to be threatened by Western technology in Soviet hands.<sup>2</sup>

Where do we stand in the technology balance? A look at some recent reports on technology and the balance between the United States and Soviet Union can put things in perspective.

#### Technology Balance

Without a solid technology base, no country can expect to field modern weapon systems. Even worse, an adversary could gain technological superiority and present us with a fait accompli. This is one area where we should place great emphasis to maintain the edge we have enjoyed over the past few decades. However, funding does not reflect US interest in maintaining this lead. Figure 6-1 shows that our level of investment to develop a technology base is now only about 60 percent of the amount we expended in the mid 1960s. There has been virtually no

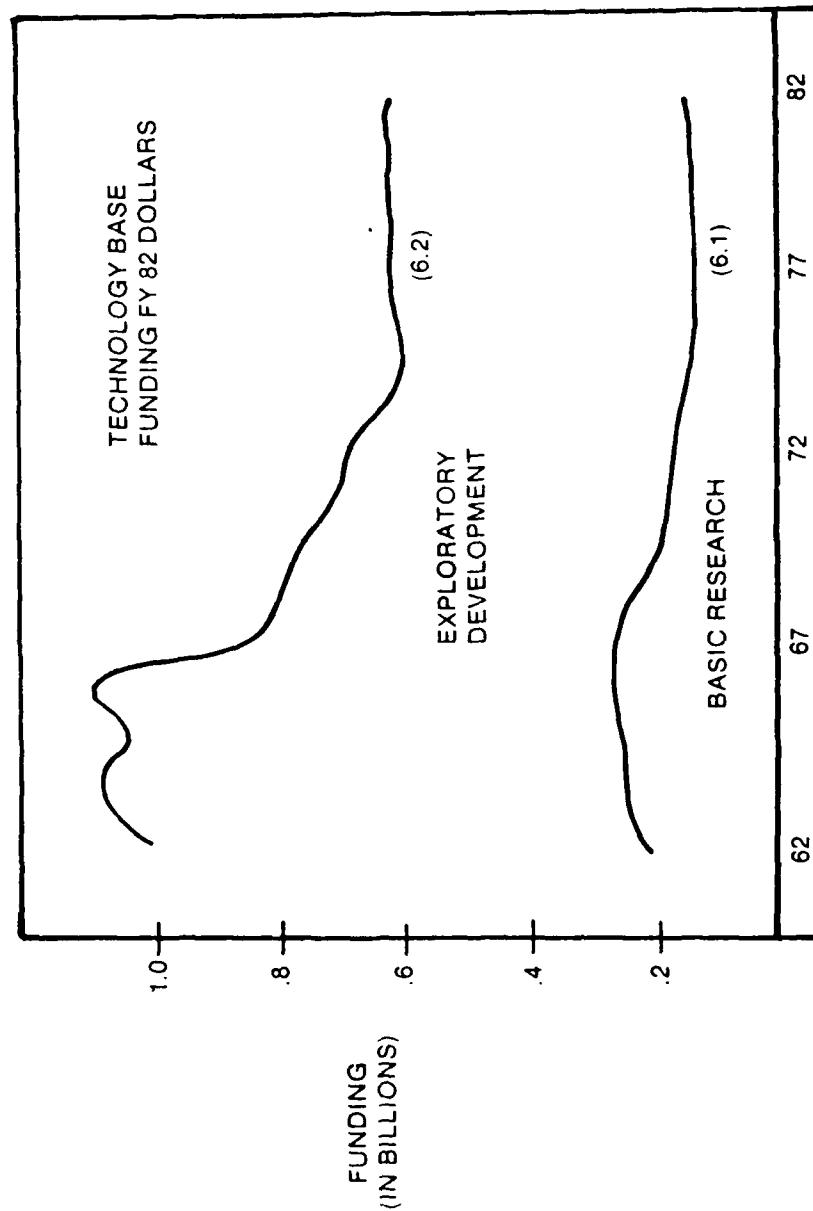


FIGURE 6-1

growth since 1976.<sup>3</sup> The technology investments we made in the 1960s provided us the technological qualitative edge we find in currently deployed systems.<sup>4</sup> Have we lost the advantage in technology? From the reports evaluated in this research it would seem not, but the trends are most alarming.

In a report on the US-Soviet military balance for 1980, a list of 63 areas of applied technologies and 38 programs of basic research was evaluated, indicating who had the lead or if parity existed. As of 1980 the United States clearly had the lead in research and technology. The straight line projections, however, paint a rather dismal picture. In basic research the Soviets were projected to be ahead in 25 of the 38 programs.<sup>5</sup> In applied technology, the Soviets were projected to lead in 40 of the 63 areas.<sup>6</sup> Unfortunately, in 1983, we are seeing the accuracy of this report. Of the 63 technologies listed, nine areas are highlighted that hold "prospect for surprise" or "most likely to create surprise." The United States leads in adaptive optics, artificial intelligence, highly energetic munitions, "smart" weapons, and quiet underwater vehicles. The Soviets lead in only two areas, directed energy weapons and controlled thermonuclear fusion. Parity exists in composite materials and our lead in computers is lagging.<sup>7</sup> All of these technologies are significant in our research on conventional weapons for strategic bombers.

The official Air Force study, Air Force 2000, divides the applicable technologies into 15 areas, which promise significant military pay-off, and indicates their importance to 10 military systems capabilities. (See Figure 6-2.)<sup>8</sup> Of these technologies, information processing, sensors, supportable electronics, stealth, and laser technology are areas that show possibilities for immediate pay-off if we chose to invest. If we add munitions to that list, we have all technologies required to develop a credible conventional deterrent force out of the strategic bomber force.

Another report, "Future of Conflict and New Technology,"<sup>9</sup> and an article quoting Dr. Richard D. DeLauer, both tend to support the status of technology and the areas we should pursue as outlined in Air Force 2000. The six immediate pay-off areas are also included in their analysis for early exploitation.

How important is it that we maintain a position of technological leadership over the Soviets? The Joint Chiefs of Staff, in their fiscal year 1983 military posture statement, say it best:

Because the Soviet Union gives no sign of relaxing its historical reliance on masses of men and equipment to prevail in war, the US must maintain a lead in military technology. Maintaining this lead will be difficult, however, since the USSR is making a determined and successful effort to reduce it. To keep the lead, and if possible extend it, the US must do more than make judicious choices in military research and development. The US must also insure that

TECHNOLOGIES / MILITARY SYSTEM CAPABILITIES	INFORMATION PROCESSING	SENSORS	SUPPORTABLE ELECTRONICS	STEALTH	LASER TECHNOLOGY	PROPULSION	SIGNAL PROCESSING	DORMANCY	RADIATION HARDENING	STOL	MUNITIONS	ADVANCED COMPOSITES	SPACE STRUCTURES	MANEUVERING REENTRY VEHICLES	SPACE POWER
SURVIVABLE ENDURING STRATEGIC FORCES	▲	● <sup>1</sup>	▲	▲	▲	▲	▲	●	▲	▲	● <sup>1</sup>	▲			
REMOTE SURGICAL STRIKE OF FIXED TARGETS	▲	●	▲	▲		●	▲		▲		●	▲			
SPACE OFFENSE AND DEFENSE CAPABILITY	▲	●	▲	▲	●	▲	●	▲	▲		▲	▲	●		▲
AEROSPACE WARFARE MANAGEMENT	●	●	●			▲	●	▲	▲		● <sup>1</sup>	▲	●		▲
OPERATIONS IN A CHEMICAL, BIOLOGICAL/NUCLEAR ENVIRONMENT		●	▲						▲		▲				
ENSURE ADEQUATE SORTIE GENERATION RATE		▲ <sup>1</sup>	▲			▲				●	▲ <sup>1</sup>	▲			
PENETRATE ENEMY AIRSPACE	▲	●	●	●		▲	▲		▲		▲	▲		▲	
OPERATIONS INDEPENDENT OF NIGHT AND WEATHER	▲	●	●	▲			▲		▲		▲				
MOBILE TARGET KILL	●	●	▲	▲	▲	▲	▲		▲		▲			▲	
RAPID GLOBAL FORCE PROJECTION	▲	● <sup>1</sup>	●			▲				▲	● <sup>1</sup>	▲			

● IMPORTANT

▲ APPLICABLE

<sup>1</sup> ADDED BY AUTHOR

FIGURE 6-2. TECHNOLOGY MATRIX

its technological community remains the best in the world, that it can avoid excessive delays in fielding new technologies, and that it does not sacrifice hard won technological advantages except in cases that clearly serve the national interests.<sup>11</sup>

Technology alone cannot win wars, but it can give us a qualitative edge to offset a numerically superior force. Many of the advances in technology will result in new technology conventional weapons that will restructure our thinking about strategies and tactics for future conflicts, both limited and total. In light of these developments, it is clear that strategic bombers, or LRCAs, can and will play a significant role in almost any area of conflict across the spectrum of warfare. Advancing the most promising of technologies and fitting new technology weapons on our older platforms, such as the B-52, and mating them to the newer aircraft will give us a force that is truly modern, as opposed to just being new.<sup>12</sup>

Secretary of Defense Weinberger's report to Congress points out the importance of the role of new technology in the President's strategic forces modernization plan and highlights the expanding capabilities of conventional weapons. He further states:

Our strategy for coping with future developments in conventional warfare, however, must not rely on technical means alone. We must seek to encourage our combat personnel to take the initiative in developing new concepts to employ our forces as skillfully as possible.<sup>13</sup>

Technology is literally knocking at our door, since we currently have the lead on the Soviets. The technological balance is in a precarious state and could go either way, depending totally upon the resolve with which we chose to pursue these developments. Success will go to that country that chooses to exploit the innovative minds of the engineers and scientists developing new technology. We cannot afford to finish second in that pursuit.

#### Potential Areas of Involvement

The world in which we live today is a very complex, yet delicate entity. The majority of the world's nations are now interdependent. This dependency revolves around economic considerations, access to critical raw materials and minerals to maintain those economies, political alliances for mutual protection, and social or ideological pursuits. The United States seeks to pursue its objectives in an environment of peaceful coexistence. As we discussed in Chapter II, we have not always been successful in maintaining that peaceful status. It is important to note that in World War II, Korea, and Vietnam, it was not the United States that struck the first blow or committed the first act of aggression. We have only become involved when our vital national interests, sovereign territory, or our friends, with whom we are aligned

for mutual defense, have been attacked. Fortunately, for the past 11 years, the United States has had none of its military forces engaged in direct conflict anywhere in the world. This is not true for the Soviet Union and many other countries of the world.

On a daily basis we can observe tens if not hundreds of areas where nations, countries, states, political parties, and religious or ethnic groups are engaged in direct combat. If we look around the world, we see conflicts of one type or another. In Europe, Southwest Asia (SWA), the Middle East, Africa, East Asia, the Pacific, South and Central America, and the Caribbean, we see open conflict and political unrest. Of what importance is it to the United States if the Soviets invade Afghanistan? If the Iraqi and Iranians fight over territory? If the workers in Poland protest over working and human rights issues? If the governments of Zambia, Zaire, or Zimbabwe are overthrown or mining in those countries is interrupted? If Israel, Thailand, or El Salvador are overrun or lost to another ideology? We could go on and on, but the important message is that in almost any area of the world, the United States has vital national interests or alliances of varying degrees.

In this research study it would be impossible to explore all potential trouble areas. However, several areas merit our attention and allow the development of scenarios where we might utilize our strategic capability of conventional bombers to insure that our vital national interests are secure. What are our interests in these areas? Why become involved? Why do we need open and accessible lines of communication (LOCs) or sea lines of communication (SLOCs)? A look at the world's "hot spots" can provide some answers. The first is considered the most difficult area where US forces might have to respond and places the greatest demand on our force projection capability.<sup>14</sup>

Southwest Asia. Access to energy resources is vital to US national interests in this area. The SLOCs, such as the Persian Gulf, are also important objectives so that any oil produced can be delivered to countries of the free world.<sup>15</sup> The approximately 7,000 miles separating the United States from the Persian Gulf presents us with our most demanding task in force projection capability. We have very few, if any, forces in Southwest Asia, and it has been generally accepted that the early days of conflict are often most decisive. In addition, timely force projection can be a stabilizing factor to prevent small crises from escalating into larger conflicts.<sup>16</sup>

The conflicts in Southwest Asia, Iran in particular, were the reason for the establishment of the Rapid Deployment Joint Task Force (RDJTF). The RDJTF, now known as United States Central Command (USCENTCOM), signifies the degree of US interest in this area. The ability to deploy a stabilizing force into this politically unstable area is most important. Open conflict and intraregional disputes are the norm for this area. The Soviets, although not directly involved except in Afghanistan, have spared no effort to assist and influence all countries of Southwest Asia. At the very heart of Southwest Asia is one of our staunchest allies and the nation crucial to stability in this area, Saudi Arabia. (See Figure 6-3.)



# MIDDLE EAST AND SOUTHWEST ASIA

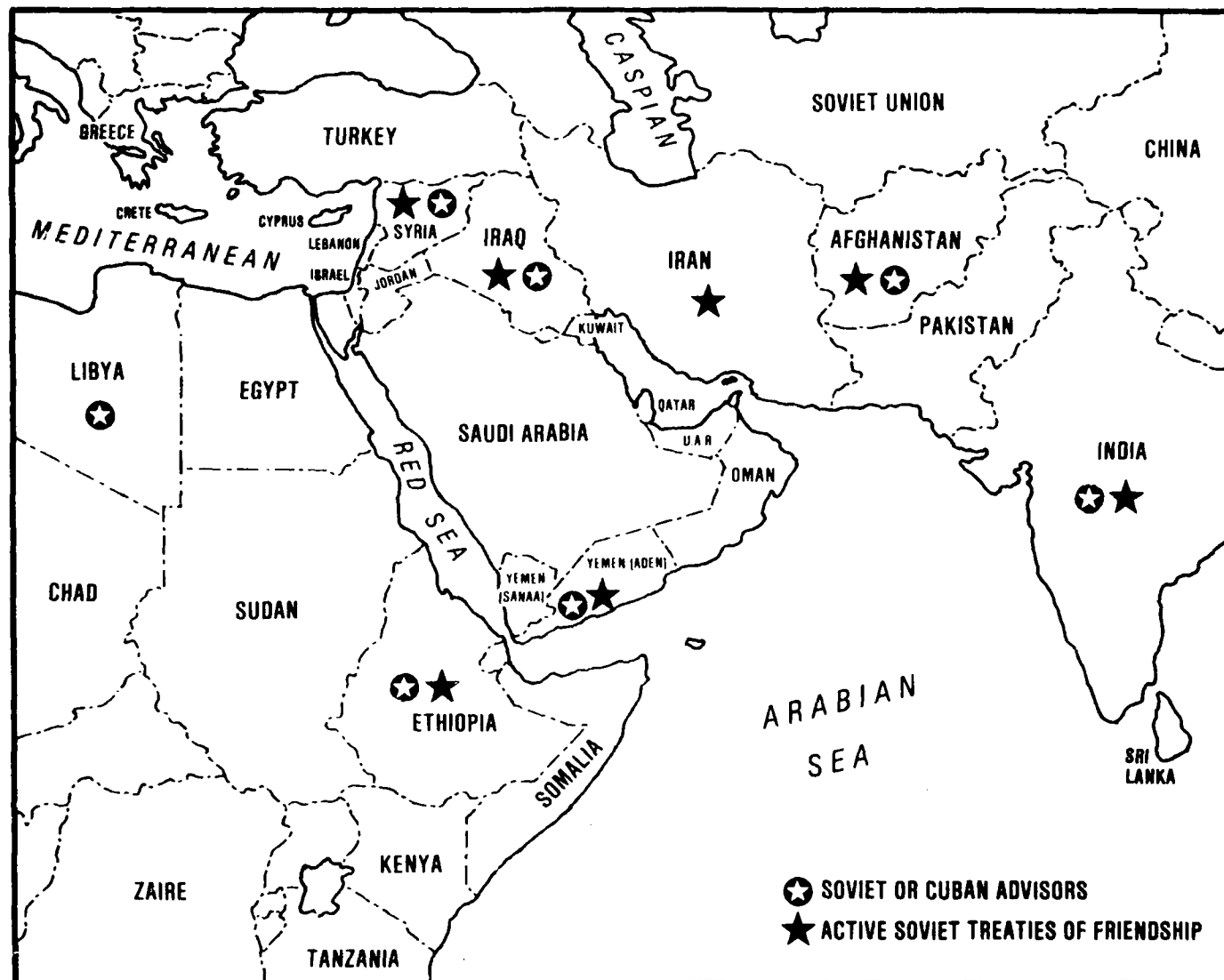


FIGURE 6-3

Saudi Arabia is one of the wealthiest countries in Southwest Asia. Its per capita output for 1982 was \$18,000, about one-third higher than the United States. All these riches stem from the Saudi oil fields. It has the world's largest proven oil reserves of over 162 billion barrels. This equals one-fourth of global reserves, and more oil is being discovered each day. The Saudis could pump oil at the present rate for the next 50 years and still not run out.<sup>17</sup> With the free world's dependence on oil for its economic survival, it is easy to see why we must do everything possible to keep this country free and militarily strong. Unfortunately, the outlook for Southwest Asia is that it will be politically unstable for years to come regardless of our success in maintaining the independence of Saudi Arabia. This situation will continue to give the Soviets fertile areas for exploitation and intervention.<sup>18</sup> Soviet activities in Southwest Asia amplify the need for US rapid deployment capabilities found in the mix of strategic bombers and new technology weapons.

East Asia and the Pacific. Of vital interest to the United States is the increasing trade with countries in this area and the many bilateral and multilateral treaties and agreements of which the United States is a signatory. More trade is now conducted with Asian nations than with Western Europe.<sup>19</sup> In order for this trade to continue, the vital sea lines of communication must be kept open. The straits of Malacca, Lombok, and Sunda are strategic passages through which oil and other goods must move to keep the Asian economy functioning. (See Figure 6-4.) The key nations with which the US is trading are Japan and China. It is of great importance to the US economy and its well being that this area not fall under the domination of any single power.

The presence of US land and air forces in Korea and Japan and the deployment of the Seventh Fleet in the Western Pacific are indicative of the degree of US interest in East Asia. Bilateral treaties with Japan, South Korea, and the Philippines, along with the Manila Pact and ANZUS Treaty, insure US participation in maintaining the independence of friendly nations in the region.

There is, however, much political instability throughout East Asia. The ongoing conflict between North Korea and South Korea, tensions between China and Taiwan, the expansionist efforts of the Socialist Republic of Vietnam (SRV), and the presence of the Soviet navy at Cam Ranh Bay in Vietnam, are all potential dangers to US national interests. The key to maintaining the status quo may be that country which ideologically is opposing the United States. That country, which is an important regional power, is China. China could be the pivotal point on which our success or failure depends. China provides the checks on Soviet attempts to dominate the area and also presents a second front to keep SRV forces occupied on the northern border. The Japanese also lend much stability to the area with their modern self-defense force. Rapid economic growth of members of the Association of Southeast Asian Nations (ASEAN) and other friendly nations are also stabilizing factors in East Asia.

# EAST ASIA AND THE PACIFIC

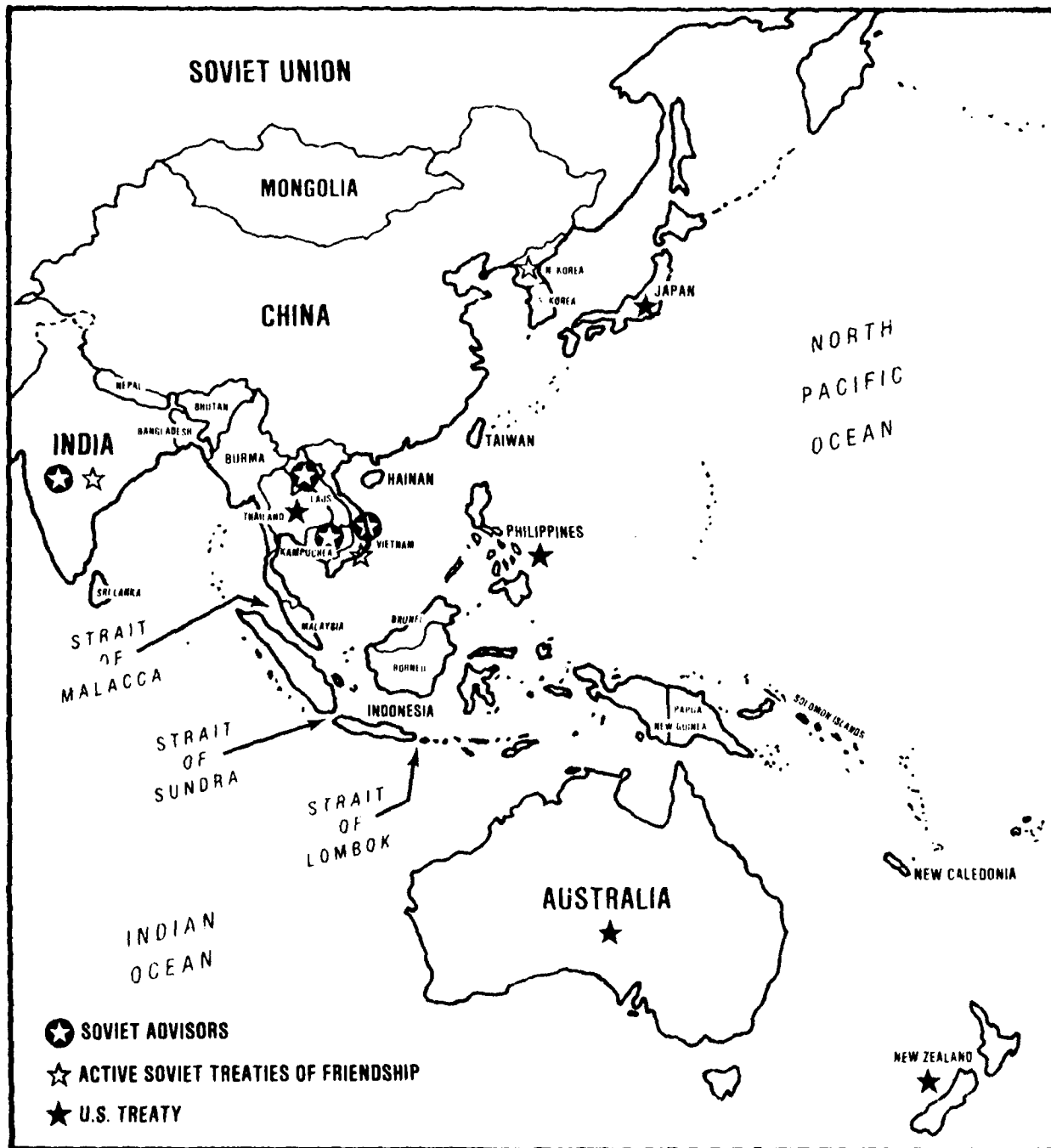


FIGURE 6 4

With forward deployed US forces, our access to military bases, and the multitude of mutual agreements, the US interest would appear to be well covered. However, strategic bombers with new technology weapons could rapidly reinforce our troops in Korea, could assist in Thailand resistance to SRV incursions, and could significantly assist the Seventh Fleet in maintaining the security of vital SLOCs.

Africa. To the average American, Africa is a land of mystery. To the US economist and industrialist, it is a vital link in our industrialized society. Besides its geostrategic location for staging of troops in the Middle East and Southwest Asia, Africa is the primary source for most of the world's critical strategic minerals. Oil is plentiful in the upper-Saharan countries, but the real treasure is the vital minerals of the sub-Saharan countries.

For example, two sub-Saharan countries, Zaire and Zambia, have approximately 64 percent of the world's reserves of cobalt. Together they produced about 61 percent of the world's cobalt for 1980.<sup>20</sup> (See Figure 6-5 for production and reserves of other strategic minerals.) Cobalt is vital to the US aviation industry. The cutoff of this one strategic mineral, up to 900 pounds of which are used in a JT8D jet engine, could paralyze the US aviation industry in less than five or six years.<sup>21</sup> In 1978 an invasion of Zaire caused a temporary shutdown of the cobalt mines and drove the price from \$6.85 per pound to \$25.00 per pound, with the spot market price increasing to an unprecedented \$50.00 per pound.<sup>22</sup> With quantum price jumps such as this, an already financially strapped aviation industry could find itself in serious economic difficulties. Failure of this industry would have a highly negative affect on the US economy.

How dependent are we on these strategic minerals? General Alton D. Slay, former Commander of Air Force System Command, stated in 1980:

The US is more than 50 percent dependent on foreign sources for over half of the approximately 40 minerals which have been described as most essential to our \$2.3 trillion economy. Many of these essential minerals come exclusively from foreign sources and some of the most critical of them come from highly unstable areas of the world.<sup>23</sup>

Does the United States maintain a strategic stockpile of these vital minerals to overcome fluctuations in the availability and price? Yes, it does but once again cobalt provides an indication:

The stockpile goal established by the Federal Emergency Management Agency for cobalt is 85,400,000 pounds; as of the first of the year, [1981] the agency reported, there was in the strategic stockpile inventory only 40,802,393 pounds--less than half what is considered adequate.<sup>24</sup>

PRINCIPAL SUPPLIERS OF CRITICAL MINERALS*		
MINERAL	PRINCIPAL PRODUCING COUNTRIES AND % OF 1980 TOTAL WORLD PRODUCTION	COUNTRIES WITH MAJOR RESERVES AND ESTIMATED % OF WORLD TOTAL
BAUXITE	AUSTRALIA 30%; GUINEA 15%; JAMAICA 14%; SUBANAME 5%; USSR 5%; BRAZIL 6%	GUINEA 28%; AUSTRALIA 20%; BRAZIL 11%; JAMAICA 9%; CAMEROON 4%
CHROMITE (CHROMIUM ORE)	SOUTH AFRICA 35%; USSR 25%; PHILIPPINES 6%; ZIMBABWE 6%; TURKEY 4%	SOUTH AFRICA 68%; ZIMBABWE 30%; FINLAND 0.7%; USSR 0.5%
COBALT	ZAIRE 50%; USSR 15%; ZAMBIA 11%; CANADA 5%; AUSTRALIA 5%; PHILIPPINES 4%; FINLAND 4%	ZAIRE 49%; ZAMBIA 15%; USSR 9%; CUBA 8%; PHILIPPINES 8%; NEW CALEDONIA 4%; AUSTRALIA 2%; MOROCCO 2%
COLUMBIUM	BRAZIL 86%; CANADA 12%	BRAZIL 79%; USSR 17%; CANADA 3%
MANGANESE	USSR 40%; SOUTH AFRICA 22%; BRAZIL 8%; GABON 8%; AUSTRALIA 7%; INDIA 6%	USSR 45%; SOUTH AFRICA 41%; AUSTRALIA 6%; GABON 3%; BRAZIL 2%
NICKEL	CANADA 25%; USSR 20%; NEW CALEDONIA 11%; AUSTRALIA 9%; PHILIPPINES 5%; INDONESIA 5%; CUBA 5%; SOUTH AFRICA 3%	NEW CALEDONIA 25%; CANADA 15%; USSR 14%; INDONESIA 13%; PHILIPPINES 10%; AUSTRALIA 9%
PLATINUM-GROUP METALS	USSR 48%; SOUTH AFRICA 45%; CANADA 5%	SOUTH AFRICA 81%; USSR 17%
TANTALUM	BRAZIL 28%; CANADA 23%; THAILAND 19%; AUSTRALIA 14%; NIGERIA 8%; RWANDA 2%; ZAIRE 2%	ZAIRE 57%; NIGERIA 11%; THAILAND 7%; USSR 7%; MALAYSIA 5%; BRAZIL 5%
TIN	MALAYSIA 25%; USSR 15%; THAILAND 14%; INDONESIA 13%; BOLIVIA 11%; CHINA 6%	INDONESIA 16%; CHINA 15%; MALAYSIA 12%; THAILAND 12%; USSR 10%; BOLIVIA 9%
TITANIUM ORES** ILMENITE	AUSTRALIA 27%; CANADA 18%; NORWAY 17%; USSR 9%; SOUTH AFRICA 7%; INDIA 4%; MALAYSIA 3%; FINLAND 3%	INDIA 23%; CANADA 22%; NORWAY 18%; SOUTH AFRICA 15%; AUSTRALIA 8%; U.S. 8%
RUTILE	AUSTRALIA 69%; SIERRA LEONE 12%; SOUTH AFRICA 11%; SRI LANKA 3%; USSR 2%	BRAZIL 74%; AUSTRALIA 7%; INDIA 6%; SOUTH AFRICA 4%; ITALY 2%; SIERRA LEONE 2%; USSR 2%
TUNGSTEN	CHINA 28%; USSR 16%; CANADA 7%; BOLIVIA 6%; AUSTRALIA 6%; U.S. 5%; SOUTH KOREA 5%; NORTH KOREA 4%	CHINA 52%; CANADA 2%; USSR 8%; U.S. 5%; NORTH KOREA 5%; SOUTH KOREA 3%; TURKEY 3%

\* MINERALS VITAL TO DEFENSE PRODUCTION WHICH HAVE LIMITED CONVENIENT SUBSTITUTION POSSIBILITIES IN THEIR MAJOR APPLICATIONS AND FOR WHICH THE U.S. IS HIGHLY DEPENDENT ON IMPORTS FOR ITS CONSUMPTION REQUIREMENTS

\*\* ILMENITE SUPPLIES ABOUT 87% OF THE WORLD'S DEMAND FOR TITANIFEROUS METALS

FIGURE 6-5

Not all of our strategic mineral stockpiles are in this condition, but it is very expensive to bring them back to the required levels once they are reduced. It is just another competitor for limited federal budget dollars.

The Soviets are well aware of our dependence on strategic minerals from this area and are always ready to exploit the political instability in Africa to their advantage. A look at the map in Figure 6-6 shows Soviet or Cuba advisors in the four largest countries bordering Zaire and Zambia.<sup>25</sup> This is an ominous note for US interests in that area.

There are many threats to US security interests in Africa. Internal conflicts, which are exploited by the Soviets, the rapid expansion of Soviet influence in Africa, and Libyan adventurism, all highlight a need for a capability to project US forces rapidly and extend US influences to this area. Only the newly established USCENCOM is available, but it already faces difficulties in fulfilling its responsibilities in Southwest Asia.

The strategic bomber, equipped with new technology, could prove a valuable asset in maintaining the oil SLOCs through the Mozambique channel and around the Cape of Good Hope at the southern tip of Africa. The ability to stop, delay, or deter another invasion of the Zaire mining areas could also be vital to US interests. Once again the strategic bomber could play a key role in achieving that objective.

Latin America. If Africa is a continent of mystery, then Latin America could be called the land of the unknown, at least as far as the average American is concerned. US interest in the Caribbean Basin and South America has been almost purely economic, rather than military, since the Monroe Doctrine was proclaimed.<sup>26</sup> The Act of Chapultepec (1945), the Treaty of Rio (1947), and the Charter of the Organization of States (1948) committed the signatories to peaceful settlement of disputes and mutual protection from aggression across boundaries.<sup>27</sup> The United States was a signatory to all these agreements.

Only in recent years have we realized the true importance of Latin America. In the area of energy, Latin America is second only to Asia in known and proven oil resources. It has about 12 percent of the world's reserves, or roughly twice that of US assets.<sup>28</sup> It could be a valuable source of oil if the 61 percent that Asia supplies were cut off or significantly reduced. Latin America is also of geostrategic importance in the distribution of the world's oil assets.

The SLOCs in the Caribbean move 60 percent of US crude oil imports and 70 percent of US refined oil imports. These SLOCs will be vital in the defense of Europe for movement of supplies.<sup>29</sup> The South Atlantic Narrows, that 1,400-mile stretch of ocean from Natal, Brazil, to Dakar, Senegal, provides the "ocean road" for one-half of US crude oil imports and fully two-thirds of all European oil imports. Probably

# AFRICA

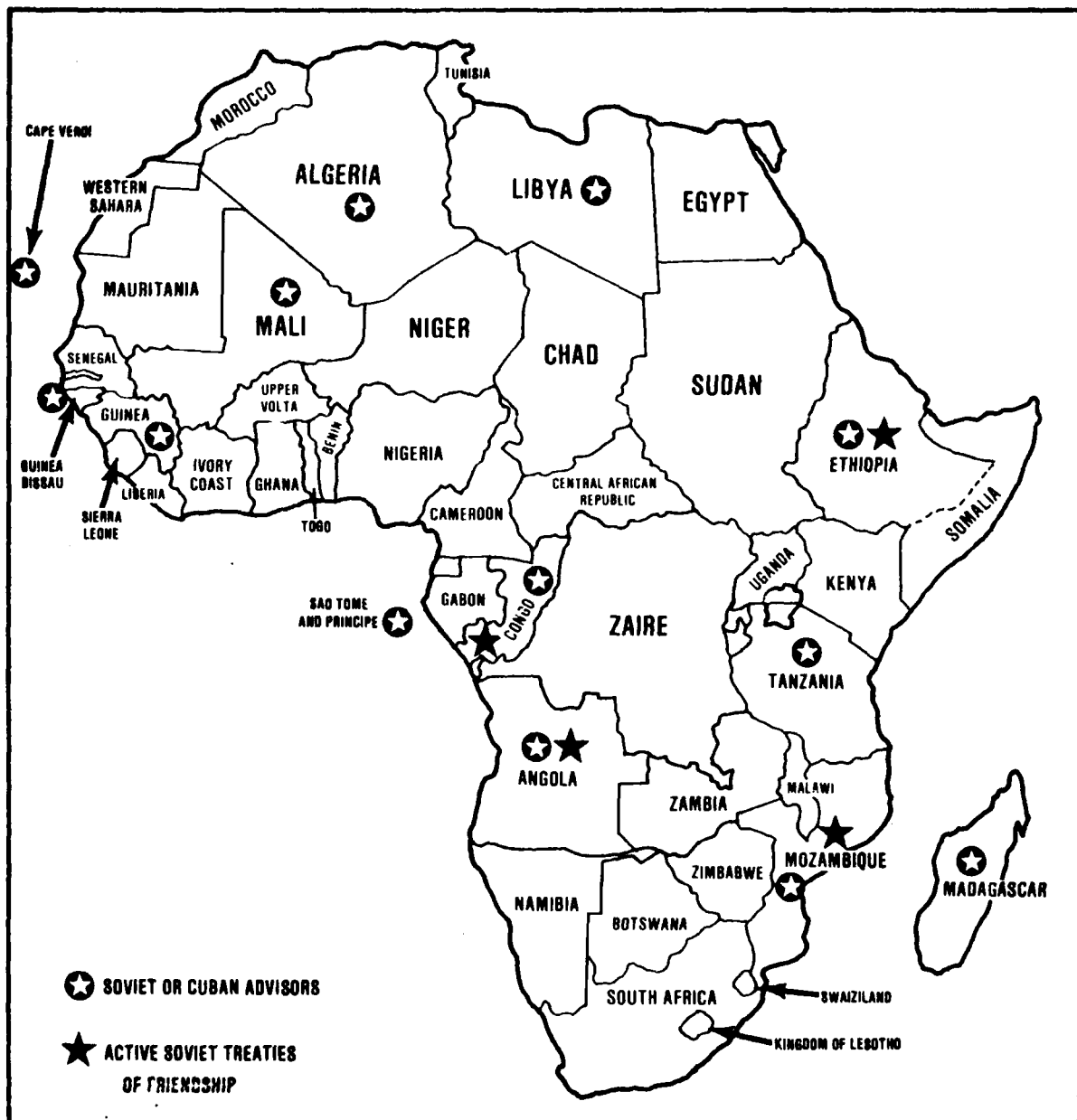


FIGURE 8-6

even more important is the 20 to 85 percent of the world's strategic minerals that are also delivered over these same routes.<sup>30</sup> (See Figure 6-7.) We can quickly see the importance of the security of waters around and through this area. Regional economic and social instability therefore are of concern to the United States.

The recent conflicts in El Salvador and our support of that government are typical of the dangers we face in Latin America. Secretary of Defense Weinberger, in his 1984 report to Congress, stated that one of our objectives in Latin America is to counter Soviet and Cuban military power and influence in the Caribbean and South America.<sup>31</sup> In an address to the Congress on the Central American crisis, President Reagan stated, "The national security of all the Americans is at stake in Central America. If we cannot defend ourselves there, we cannot expect to prevail elsewhere."<sup>32</sup> There is much evidence that ties Nicaragua, Cuba, and the Soviet Union together in an effort to disrupt the normal order of business in the Caribbean. This instability poses a most serious threat to US interests in Latin America.

If US military intervention were required or requested by any country of Latin America, a force of strategic bombers armed with a combination of new technology weapons, and even munitions currently in the inventory, could provide rapid sustained operations from US bases. Almost any point in the Caribbean or any of the SLOCs are within four hours flight time from the United States, simplifying our logistics requirements.

This area is extremely volatile and merits the continued interest of the US government at all levels. The freedom and independence of nations in Latin America could directly affect the well being of the economic and social order of the United States.

Middle East. The problems discussed earlier on Southwest Asia are equally applicable to the Middle East when discussing the requirements for rapid force projection. These two areas are contiguous and by some definitions overlap one another.<sup>33</sup> (See Figure 6-8.) The primary driving force of US Middle East policy will continue to be our commitment to Israeli independence. Continued access to natural resources and use of SLOCs are also keys to US interest. The Palestinian Liberation Organization (PLO) is a well-known and difficult problem that the United States must help resolve. This instability heightens the importance of the development of a viable, rapid-reacting force to counter aggression in the Middle East. Properly equipped and armed, the strategic bomber could provide that force.

Western Europe. This area, unlike the other "hot spots" just described, does not have as great a need for rapid force projection. This is not to say there is no threat, but we already have both ground and air forces throughout this region. The employment of strategic bombers, armed with new technology conventional weapons, would be helpful but not nearly as beneficial in the European theater as in other areas where we have few, if any, US forces present.





FIGURE 6-7

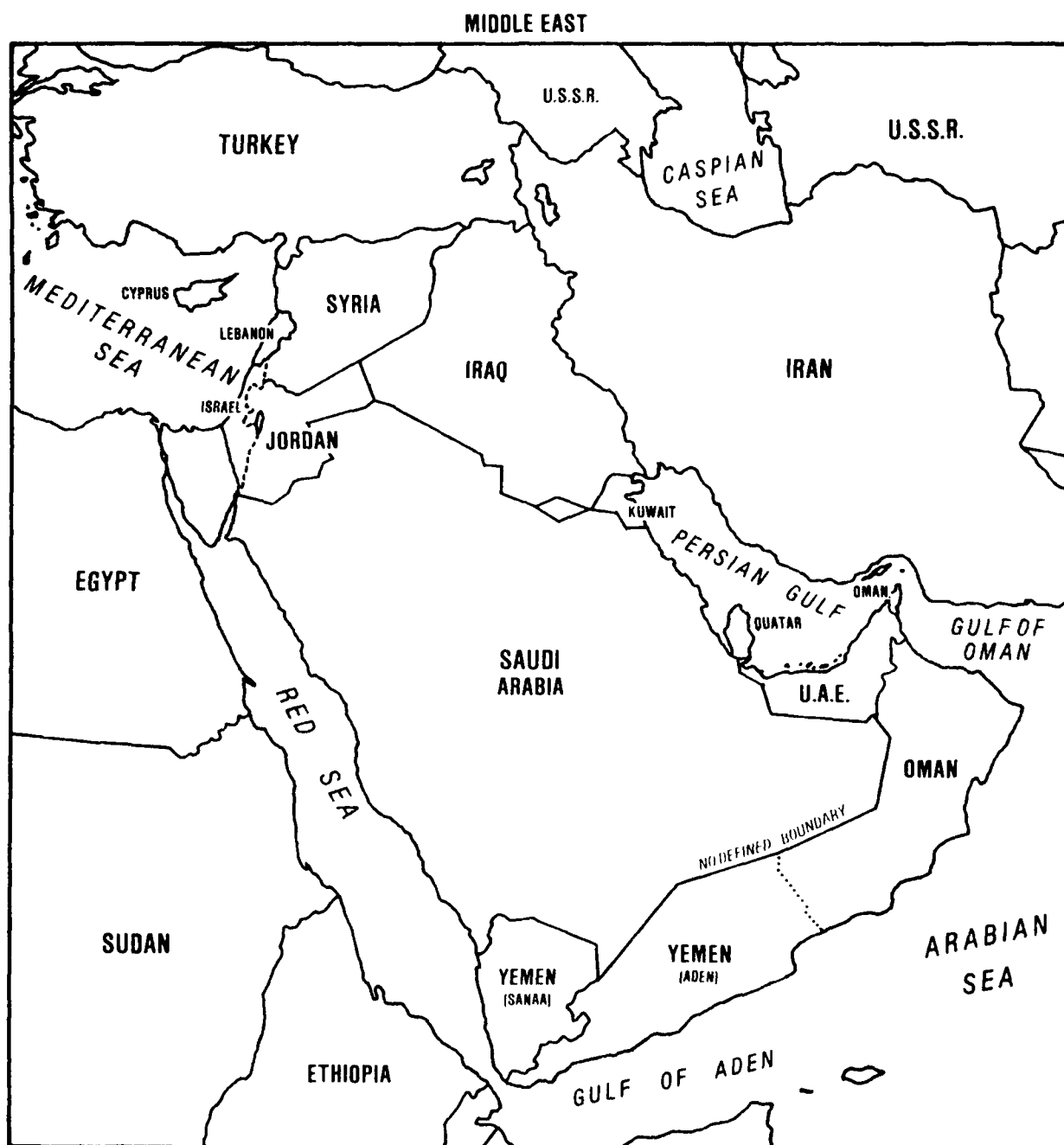


FIGURE 6-8

Besides our traditional linkage with Western Europe, we are bound more solidly to that area as a member of the North Atlantic Treaty Organization (NATO). (See Figure 6-9.) The North Atlantic Treaty was eventually signed by 14 nations of Western Europe, Iceland, and the United States. Members pledge to protect one another, even if military forces are required to maintain the security of the North Atlantic area. Because of the strong alliance in NATO, which directly opposes a massive Soviet Warsaw Pact conventional threat, and the ready presence of US forces, little discussion of this area is required in the context of rapid deployment with long-range strategic bombers. NATO should remain in the domain and under protection of tactical air forces, land forces, and the Sixth Fleet in the Mediterranean.

### A Question of Strategy

In the preceding section we saw that the potential for conflict is truly on a worldwide basis. In the remainder of this century, we will need the capability to protect our interests in many diverse areas and on various levels of conflict. Do we have that capability? Are we developing the forces, munitions, and strategy to make our plans feasible? In his 1982 book, The Future of Conflict, William J. Taylor, Jr. comments on the Rapid Deployment Joint Task Force (RDJTF):

Now, however, almost three years have elapsed since its formation, and it is not entirely clear just what threats the current RDJTF is designed to counter, where or how it will be deployed, or what weapons systems are planned for its use.<sup>35</sup>

Mr. Taylor's statement remains valid today. He emphasizes the difficulties the United States has had in establishing conventional strategy even after the threat has been recognized. Part of the conventional force projection problem is in the perception of the term "strategic." The demarcation line between strategic and tactical aircraft employment has been blurred by the development of highly sophisticated, accurate, and flexible standoff weapons. Our military planners, strategic thinkers, and policymakers appear confused by this subtle change in the definition of strategic. What caused this confusion? A review of how this "strategic mindset" developed may be explained.

Following World War II, the United States demobilized very rapidly, while the Soviets maintained a large conventional force on their European border. To counter this force, the Western Europeans and the United States relied on our nuclear monopoly instead of a large, standing conventional army. As a result, nuclear power dominated US grand strategy. President Nixon later noted, "American strategic superiority after World War II was critically useful to us. . . . It was the center of gravity of our political weight."<sup>36</sup> The nation wanted a lasting peace. From the power derived from Hiroshima and Nagasaki, the United States thought it had the ultimate weapon to insure peace.

# WESTERN EUROPE, NATO AND THE WARSAW PACT



NATO
  WARSAW PACT

- \* MEMBERSHIP IN NATO PENDING
- \* \* DOES NOT PARTICIPATE IN INTEGRATED MILITARY STRUCTURE

FIGURE 6-9

Writing about the atomic bomb, Stefan T. Possony in 1949 wrote, "as a 'master weapon' against which there is no defense, it will monopolize the future of warfare."<sup>37</sup> Nuclear weapons had created the impression that other weapons were condemned to oblivion or reduced to unimportance.<sup>38</sup> The delivery aircraft, the strategic bomber, was indelibly linked to the nuclear weapon and the two terms "strategic" and "nuclear" became synonymous. Strategic airpower had been relegated to an almost exclusive role of delivering nuclear weapons.

That view of the strategic employment of airpower persists even today. The perception is reinforced by the Air Force's manual on basic doctrine that states, "The strategic triad has three nuclear force components . . . intercontinental ballistic missiles, submarine-launched ballistic missiles, and manned bomber aircraft."<sup>39</sup> The outcome of this confusion of terms has been a reluctance to plan for and recognize the total potential of strategic airpower.

Strategic is defined by Webster as, "designed or trained to strike an enemy at the source of his military, economic, or political power."<sup>40</sup> Further, JCS Publication 1 defines strategic air warfare as:

Air combat and supporting operations designed to effect, through the systematic application of force to a selected series of vital targets, the progressive destruction and disintegration of the enemy's war-making capacity to a point where the enemy no longer retains the ability or the will to wage war. Vital targets may include key manufacturing systems, sources of raw materials, critical material, stockpiles, power systems, transportation systems, communications facilities, concentration of uncommitted elements of enemy armed forces, key agricultural areas, and other such target systems.<sup>41</sup>

A new and broader understanding of the term "strategic" is necessary if the full potential of strategic airpower is to be realized. Strategic forces capable of long-range conventional strike should be employed to take advantage of large payloads and rapid reaction times. Strategic conventional forces should be used where others cannot reach in the time constraints of the conflict's tempo.

The historical legacy of strategic bombing theory and the close association of strategic assets to the role of nuclear deterrence is the most difficult issue to overcome. Once a change in the definition of the term "strategic" is accepted, a seemingly limitless variety of potential roles, missions, and targets are available through the use of new technology weapons and creative thinking. Air Force Chief of Staff General Charles A. Gabriel, stated:

Today, we, too, need to be open to new ideas. We must be willing to broaden our perspectives in the search for the best strategy and combination of forces to meet our future security requirements.

We are serious about tailoring our forces for combined operations. We cannot afford parochial and separate approaches that waste scarce resources and do not produce the effective fighting forces our country requires.<sup>42</sup>

The concept of a strategy, in which strategic bombers are used for previously "tactical only" targets, is difficult for many to accept. However, the introduction of new technology has allowed this concept to become a reality. Given that a conventional strategy is developed, do we have the forces available to do the job today? Tomorrow? A look at current limitations of our forces and projected strategic force structure may provide answers to these questions.

### Existing Forces

There are three separate forces capable of providing the conventional delivery of air-to-ground weapons in a force projection role. The strategic projection force (SPF) of Strategic Air Command (SAC), Tactical Air Command (TAC) fighters, and the air arm of the Navy's carrier task forces are all capable of weapons delivery, but each has shortfalls when using today's weapons and tactics. A look at the problems of each force gives us some perspective.

TAC fighters have basically four problems when employed in a force projection role. First, the present-day fighters, F-15, F-16, and F-111, are limited by range and would require a sizeable aerial tanker fleet to get them to the scene of conflict. Extended on station time would also require more tankers for force effectiveness. Second, access to forward basing may be denied our forces, and fighters might be forced to "round trip" each mission. This places unacceptable physiological demands on the fighter pilot and has an impact on safety and effectiveness. Third, the fighter sensor capability (radar) is inadequate for long-range target surveillance and acquisition. The physical limitations of antenna size and weight, space for computer processing equipment, and pilot work load are difficult problems to overcome. Last, the low firepower, or weapons carriage limits of TAC fighters, would make the question of cost per targets killed per sortie a valid consideration.

Naval carrier aviation fighters share the same problems as TAC fighters with the exception of access to forward bases. The Navy fighters bring their bases with them. This however, creates another problem unique to the Navy. Even with the 15 carrier task forces desired by the Navy, the problem of task force location and sustained operations still remains. There will still be many areas where only one carrier task force will be within reasonable steaming time of the potential conflict area. Once in the area, protection of the fleet is of primary concern in addition to attempting sustained conventional operations. Defense against submarines, surface-to-surface missile ships, long-range interceptors, and even other enemy carriers presents the Navy with some unique and demanding tasks in conventional force projection.

The SAC bomber forces assigned to the SPF (35 B-52Hs) have overcome the problems of range, payload, and access to forward bases but share with the fighters a limited sensor capability problem. The current radar on the B-52 is not capable of long-range target detection, classification, and meeting weapons guidance requirements of new technology weapons. The B-1B is outfitted with a synthetic aperture radar (SAR) and moving target indications (MTI) capability. This is a step in the right direction. The current SPF, although limited in size, is the fastest reacting and most capable force projection unit available to our national command authorities today. With the installation of a new radar sensor and development of standoff weapons, the SPF would become a truly potent fighting force.

The bottom line is that the existing forces today do not provide us with adequate conventional force projection capability. Do we have to accept this situation or are there affordable alternatives to correcting this dilemma? A look at the projected strategic bomber force structure may provide a solution.

#### Projected Strategic Bomber Force Structure

President Reagan's modernization of the bomber forces is a welcome relief to military planners who are contemplating the increasing Soviet threat. Modifications to the B-52G and B-52H, production of a vastly improved B-1B, and rapid development of the advanced technology bomber (ATB) will provide a very capable strategic bomber force for the nuclear mission. However, the conventional capabilities of these systems do not appear to be the center of interest in the current modernization program.

In fact, with the retirement in 1983 of the B-52D, which is the primary conventional weapons carrier for SAC, much of the long-range conventional bombing capability will be lost. Because of budgetary considerations, these aircraft will not be replaced and this leaves us in a dilemma. The new B-1B and ATB will be on line by 1985 and early 1990s, respectively. These aircraft could have a significant conventional capability. But do we want to use such expensive aircraft as these in a conventional role? If we are talking about delivery of today's conventional gravity weapons, the answer probably is no. As we saw in Chapter IV, attrition due to improved defenses in the target area could extract a heavy toll from any aircraft requiring target overflight. If we pursue the development of new technology conventional standoff weapons with delivery ranges from 100 to 300 miles, then we can take full advantage of the improvements being built into these new bombers. This, in turn, would provide leverage and significantly improve our conventional force projection capability.

The difficulty in discussing the B-1B and ATB is that the first production B-1B is not off the line yet, and all of the advanced technologies for the ATB are not fully developed. Assuming that both

these aircraft will turn into "rubber on the ramp," in spite of annual budget difficulties, then we can speculate on how the strategic bomber force structure will look until at least the year 2000. Figure 6-10 shows the bomber force structure as outlined by Secretary of Defense Weinberger in his fiscal year 1984 report to the Congress.<sup>43</sup> Figure 6-11 shows the historical and planned number of bombers in the active inventory of the Air Force at the end of each fiscal year. What force structure message can be derived from looking at these two charts? Two items become readily apparent: size and emphasis.

Since 1972 we have seen a dramatic decline in our total bomber inventory and an increased emphasis on the nuclear mission area--single integrated operational plan (SIOP)--for strategic bombers. The decline in numbers is the result of normal peacetime attrition, obsolescence, lack of logistical support, and increasing costs of operating older aircraft in an economically stressed budget. The emphasis on the SIOP mission is appropriate. We must modernize and maintain the nuclear force since it is our best deterrent. With a decline in total force structure, the number of aircraft available to use in a conventional or collateral maritime role is also significantly reduced. Today's force structure has 75 B-52Ds and 35 B-52Hs (SPF) available for the conventional/maritime missions. By 1985 the B-52Ds will be gone, and B-52Hs will have converted to the full ALCM or cruise missile carrier role. This leaves only a force of 61 primary aircraft authorized (PAA) B-52G aircraft to assume this shortfall.

Is that force structure adequate to fulfill all conventional force projection and maritime requirements that are levied on the strategic bomber force? If we could be sure that each sortie flown was effective and each aircraft returned home safely, then we could probably sustain a limited capability. However, that assumption would ignore the lessons from history we noted in Chapters IV and V. The historical attrition rate of about two percent would probably be greater when faced with modern and more lethal air defenses. In their present configuration, the available 61 B-52Gs do not provide a sufficiently large, nor effective enough, force to meet the total anticipated requirements. Besides the "standard" major support requirements in Europe, Korea, and the collateral role in maritime, we could also be embroiled in any of the potential areas of involvement discussed earlier in this chapter.

It appears that our ability to increase the number of aircraft dedicated to the conventional/maritime missions is limited. How then do we approach the problem? If the size of the force is fixed, then all we can do is make what we have more capable and effective. In other words, we need something that will act as a force multiplier. Can this be done? Advancements in technology can provide an answer. Two areas, improved sensors (radar) and long-range standoff conventional weapons, could give the leverage or multiplier effect we desire. A discussion of each of these areas and various options would be helpful in evaluating this approach to our dilemma.



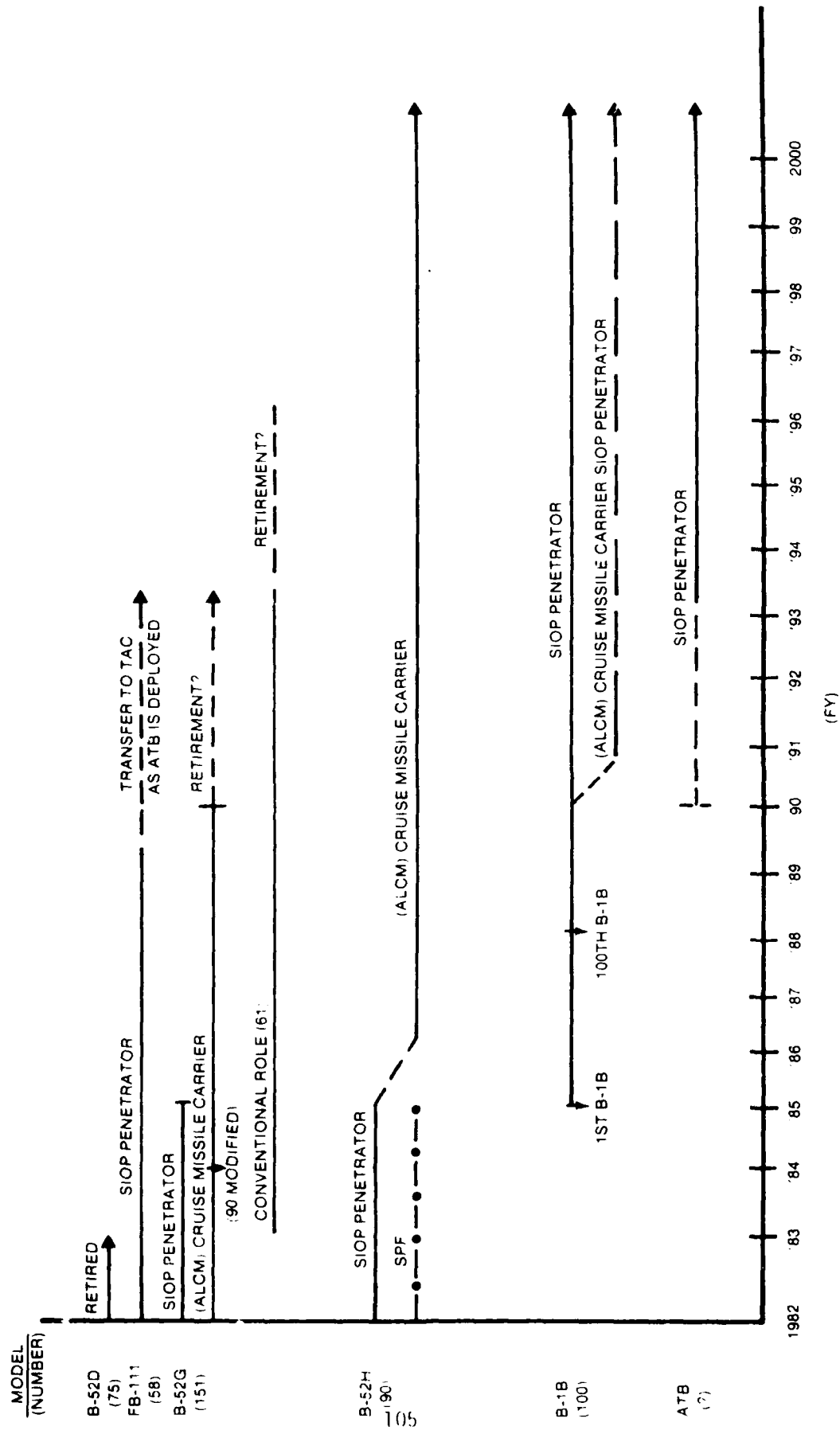
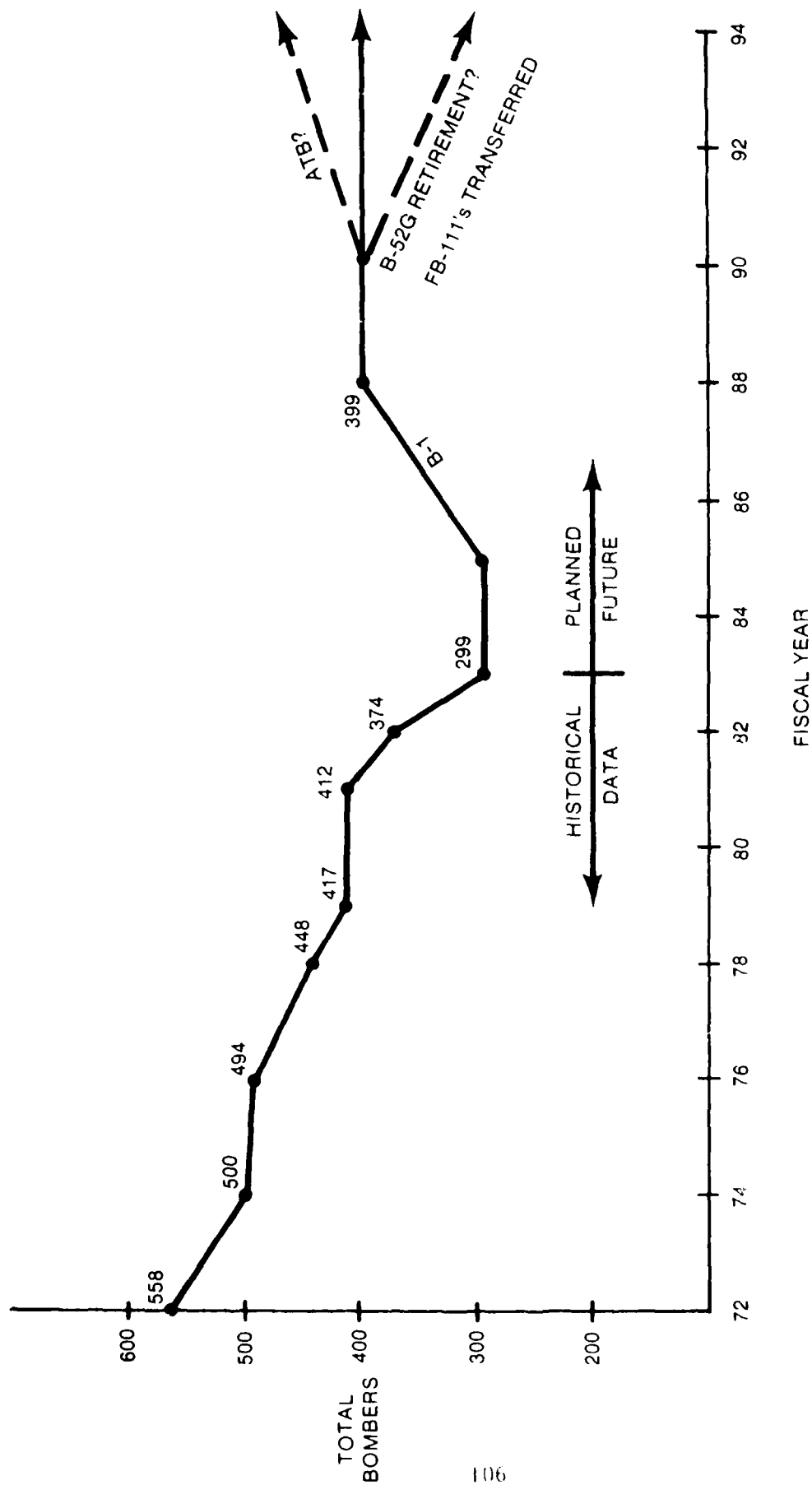


Figure 6-10 Planned Strategic Bomber Force Structure (PAA) 43



Source: US, Summary 1982. Cost and Management Analysis, Comptroller of the Air Force, pp. 3-5; SECDEF FY 1984 Annual Report to Congress, pp. 223-224.

Figure 6-11. USAF Bomber Aircraft Inventory

### Sensors--Autonomous or Cooperative?

The Air Force 2000 study indicates that improved sensors have a high possibility of payoff for military applications.<sup>44</sup> (See Figure 6-2 for military systems capabilities.) Even without new breakthroughs in technology, we currently have sensors available that are off-the-shelf and proven and can help in solving the conventional/maritime force projection equation. The question is which road to take? Do we press for an autonomous strategic bomber capability, or do we attempt to operate in a cooperative role with a specialized mission aircraft?

One specialized mission aircraft under consideration today is the airborne warning and control system (AWACS) or E-3A. This aircraft has an excellent synthetic aperture radar (SAR), inverse SAR (ISAR), moving target indicator (MTI), and is also capable of detecting maritime targets. Its primary function is detection, surveillance, and tracking of low-, mid- and high-altitude aircraft. The extensive communications capabilities on board this aircraft give it excellent command and control characteristics. The E-3A has range, speed, and endurance capability similar to that of the B-52 and B-1B.<sup>45</sup> It is also air refuelable, as are the strategic bombers mentioned.

The broad range of radar coverage of the AWACS makes this aircraft especially capable of operating with the strategic bomber in the maritime role. The AWACS can search over a fifth of a million square miles of ocean in a single hour--about four times the limited radar capability of our current B-52.<sup>46</sup>

The problem in using the AWACS in a cooperative role is a matter of numbers and priorities. The Air Force has a limited number of E-3As today and faces the same funding problems when attempting to expand its force structure. The high-priority mission assigned to AWACS in the NATO area, in the Pacific, and here in the United States for CONUS defense would be even more important to maintain if we were engaged in conventional operations in other parts of the world. Another obstacle in using the AWACS in a cooperative land attack role is the optimization problem. The AWACS has been optimized for air-to-air surveillance and performs that role very well. Attempting to acquire and identify slow-moving or fixed-ground targets in "ground clutter" is contrary to the air-to-air requirements. For the land attack requirement, another airborne sensor platform has been proposed. It is the Joint Surveillance and Target Attack Radar System (JSTARS).

The JSTARS in a joint Air Force/Army program incorporates a number of separate service programs into a single answer for a problem of both services. Basically, this effort envisions use of an airborne radar that will detect, track, and direct real-time attacks against slow-moving and fixed-ground targets. This \$2 billion program is beset with the same trade-offs of many joint efforts. Areas of concern include the resolution of complex radar-range requirements and the aircraft platform to be used. The Air Force is viewing the TR-1 (a U-2 derivative) or a modified Boeing 707 as possible platforms.<sup>47</sup>

For rapid force projection capability with strategic bombers, the TR-1 would be incompatible. The 707 option would fill range, speed, and endurance requirements. However, the major thrust of this program is aimed at the NATO arena where the detection and destruction of second echelon armor could prove a decisive factor in a conventional battle against the Warsaw Pact forces. Once again it is a matter of priority usage and limited numbers proposed to do the job. The last and major consideration for this system is that it has not yet been approved for full scale development (FSD).

So now we have two specialized aircraft to go along with our force of strategic bombers. Will specialized aircraft be available when needed? Can we afford them? Are there other less costly sensor solutions to the rapid, worldwide, conventional force projection problem? The answer to the first two questions would be as varied as the number of persons asked. There is a viable, affordable alternative that appears attractive.

A recently completed study, which was conducted under an Air Force contract, concludes that a strategic bomber (B-52) equipped with the proper sensor and standoff weapons could stop intervention forces over land and act as a force multiplier for naval support missions.<sup>48</sup> The approach would be to equip the B-52 with a high resolution radar, having SAR, ISAR, and MTI, that would give the B-52 a conventional standoff capability (CSC) to detect both land and maritime targets. This approach looks sensible for many reasons. The issues of cost, availability, commonality, and flexibility are only a few that come to mind.

It is estimated that developing and integrating an improved radar sensor for those 61 (PAA) B-52s would cost only about one-half the \$2 billion estimated for JSTARS. This is not to say JSTARS should not be developed, but it would free that system as well as the AWACS to remain committed to the NATO mission in Europe. Availability and flexibility are inherent if this sensor capability is provided on board the attacking bomber. The issue of commonality is easily overcome. The B-1B, F-16, Army DIVAD gun system, and the AWACS share similar radars, or at least use major components by the same company. The additional benefit of this approach would be the transfer of this technology to the B-1B and even the ATB when a decision is made on the future of the B-52. Besides having the ability to locate, classify, and identify land or maritime targets, this system would also be able to guide standoff weapons to the target with great accuracy. This capability would allow much less expensive terminal guidance to be employed on a variety of long-range standoff conventional weapons. Any of the weapons in the standoff class, such as JTACMS, MRASM, or GBU type, could be used.

The ability to locate, classify, and identify targets and guide the weapons with precision decreases the number of sorties and weapons required for target destruction. This provides a multiplying effect for the bomber force.

The preceding discussion indicates that an autonomous sensor capability would be the most desirable, at least in view of today's options. As previously mentioned, the sensor is only half the problem. The other requirement for long-range, standoff conventional weapons could also serve as a tremendous force multiplier for a small conventional B-52 force.

### Standoff Weapons--A Force Multiplier

Various options, types, and ranges of standoff conventional weapons discussed in Chapter V will not be repeated here. The purpose of this section is to show some generic facts comparing new technology weapons to today's capabilities.

If we attack a target with today's gravity-delivered weapons, we can only expect one "target" kill per pass. To achieve more kills means more passes or more sorties over the immediate target area. Neither of these options is desirable. The answer lies in improved air-to-ground munitions. In the case of standoff weapons, the submunitions are a vital link in the solution. "Smart" submunitions are those that incorporate new technology and microelectronics to achieve the theoretical kill capability of one target per submunition. "Dumb" submunitions are those that are simply dispersed in a target-rich environment in large numbers, thereby achieving multiple kills per pass.

Assuming we use standoff weapons loaded with "smart" submunitions, how good are they? If each B-52 (or B-1B or ATB) carried 20 weapons, with only 30 submunitions per weapon, each B-52 would have a theoretical limit of 600 kills per sortie. Being pessimistic is always a safe approach, so let us say that only half of the standoff weapons reach the target area and only 20 percent of the submunitions actually hit their target. This still provides each strategic bomber with 60 kills per sortie. Quite an improvement in force structure offensive potential. The force multiplier effect should be obvious.

Equipped with appropriate standoff weapons and sensors, a small, but potent, dedicated strategic bomber force could be a deciding factor in conventional force projection anywhere in the world.

### A Dedicated Conventional Bomber Force

In 1981 Congress directed that the B-1B is to be a multirole aircraft. As such, it is capable of flying all conventional nuclear missions that are now flown by the B-52.<sup>49</sup> However, as much as we would like to propose the B-1B for a fully dedicated conventional force, it is simply not economically, politically, nor militarily a viable choice. Perhaps when the 21st century rolls around and the B-1B is no longer a new aircraft and the ATB has been around for 8 to 10 years, then this

highly capable aircraft may become a truly multirole aircraft. Returning to our previous discussion on force structure, we see the B-52G as the only contender for this role.

We might ask several questions at this point. Why should we establish a dedicated conventional force at all? And why use the B-52G? There are four important factors to consider when answering these questions. (1) Of what value is a conventional bomber force to us politically? (2) Can we afford it? (3) Is it available in the near term? (4) Does a conventional bomber force maintain flexibility for other roles? Let us review these factors in more detail.

Politically, the establishment of a dedicated conventional bomber force would be a strong signal of intent to any potential adversary that the United States is serious about protecting its national interests and allies anywhere in the world. An existing highly powerful force is definitely an indicator of a strong resolve. The idea of a "small" force that could fulfill this role would also be politically acceptable here in our country. Even the American public would accept a program that would allow response options other than nuclear. Because a conventional bomber force could be rapidly deployed from continental United States (CONUS) to an area of conflict or to a forward operating base (FOB) before hostilities began, its presence alone could preclude any further action by an enemy force. The political value of a conventional bomber force might be as valuable in a third world crisis as the SIOP force is in maintaining nuclear deterrence.

We can never get something for nothing. We have to pay a price for improving our force posture, so let us do it in the most cost effective way. A recent study evaluated the cost effectiveness of using wide-bodied, commercial aircraft as conventional cruise missile carriers as opposed to the B-52.<sup>50</sup> The overall results were that the B-52 was more cost effective. This was due primarily to the "sunk cost" of the B-52; we already own it. An 18-month B-52G/H damage tolerance analysis has recently been completed by Boeing, and the analysis concluded that the aircraft is structurally sound and should remain so through this century. Based on 1981 utilization rates, the aircraft would require no structural modifications until after the year 2002.<sup>51</sup> It makes good sense to add modern weapons to older aircraft if they are still sound. In Chapter IV, we pointed out that the British did quite well with the AIM-9L and the "old" Harrier jets. Finally, rough estimates on cost to modify a 61 (PAA) B-52G fleet for full conventional standoff capability is around \$.5 billion. This estimate is slightly less than the cost of two and one-half B-1Bs or one squadron of F-15s. (It does not include the cost of the standoff weapons; only the sensor, carriage capability, and integration costs were cited.) It appears this capability is affordable and is more a matter of force structure or program choices than actual dollars.

The availability and flexibility questions are no "show stoppers." From the planned force structure, we can see that these

B-52Gs are not to be modified for air-launched cruise missile (ALCM) carriage. They are intended to retain their nuclear delivery capability for gravity weapons and short-range attack missiles (SRAM). As long as they are not modified as ALCM carriers, they will retain dual conventional/nuclear capabilities. The forces are available today. There are no technological miracles required to equip the B-52G with a high-resolution sensor or produce the standoff weapons required. Many other weapons programs, the ALCM, GLCM, SLCM, SRAM, and Harpoon, have already proven we can build highly accurate, effective standoff weapons. All of the required technologies are available today. Probably best of all is that gaining any experience or technology improvements would be directly transferable to the B-1B or maybe even the ATB. Availability of the forces and technology does not seem to be an obstacle in creating a dedicated conventional bomber force.

The establishment of a dedicated B-52G conventional bomber force is politically, economically, and technically possible. In fact, the recent (1983) establishment of two Harpoon equipped B-52G squadrons, one at Loring AFB, Maine, and the other at Anderson AFB, Guam, could form the core of a conventional bomber force. Although these B-52G aircraft are to be used in a cooperative maritime role, with the E-3A or AWACS providing sensor capability and target information, it is not difficult to see an expansion to a full conventional bomber force.

#### Considerations for a Conventional Bomber Force

The establishment of a dedicated conventional bomber force would be a departure from the normal SAC operations. Changes would have to be made in guidance and planning factors for establishing a primary mission of conventional and maritime combat operations and a secondary mission of SIOP support for these forces. Many other factors outside the scope of this study would also have to be addressed. For example, a detailed concept of operations would include: (1) basing--both CONUS and overseas, (2) resources--aircraft (B-52, KC-135, KC-10, E-3A), personnel, and logistics (munitions, aircraft support equipment), (3) response posture--conventional alert, training, SIOP proficiency, and (4) mission planning and tactics. The changes do not present insurmountable problems, but they would require a lot of coordination and some unconventional approaches to difficult parochial issues.

Given that we had a dedicated conventional bomber force of 61 B-52G aircraft, how would we employ them in a crisis situation? The next section on selected scenarios should provide some further insights.

#### Employment Scenarios

The selection of the proper scenarios to establish the utility of a dedicated conventional bomber force (DCBF) is a highly subjective

task. First, my biases or assumptions are going to influence the image you receive from these scenarios. These biases will be stated up front so you will understand my perspective. Second, to insure some degree of validity in our assertions, the scenarios will be based on potential areas of conflict that actually exist today. The assumptions are important and need explanation.

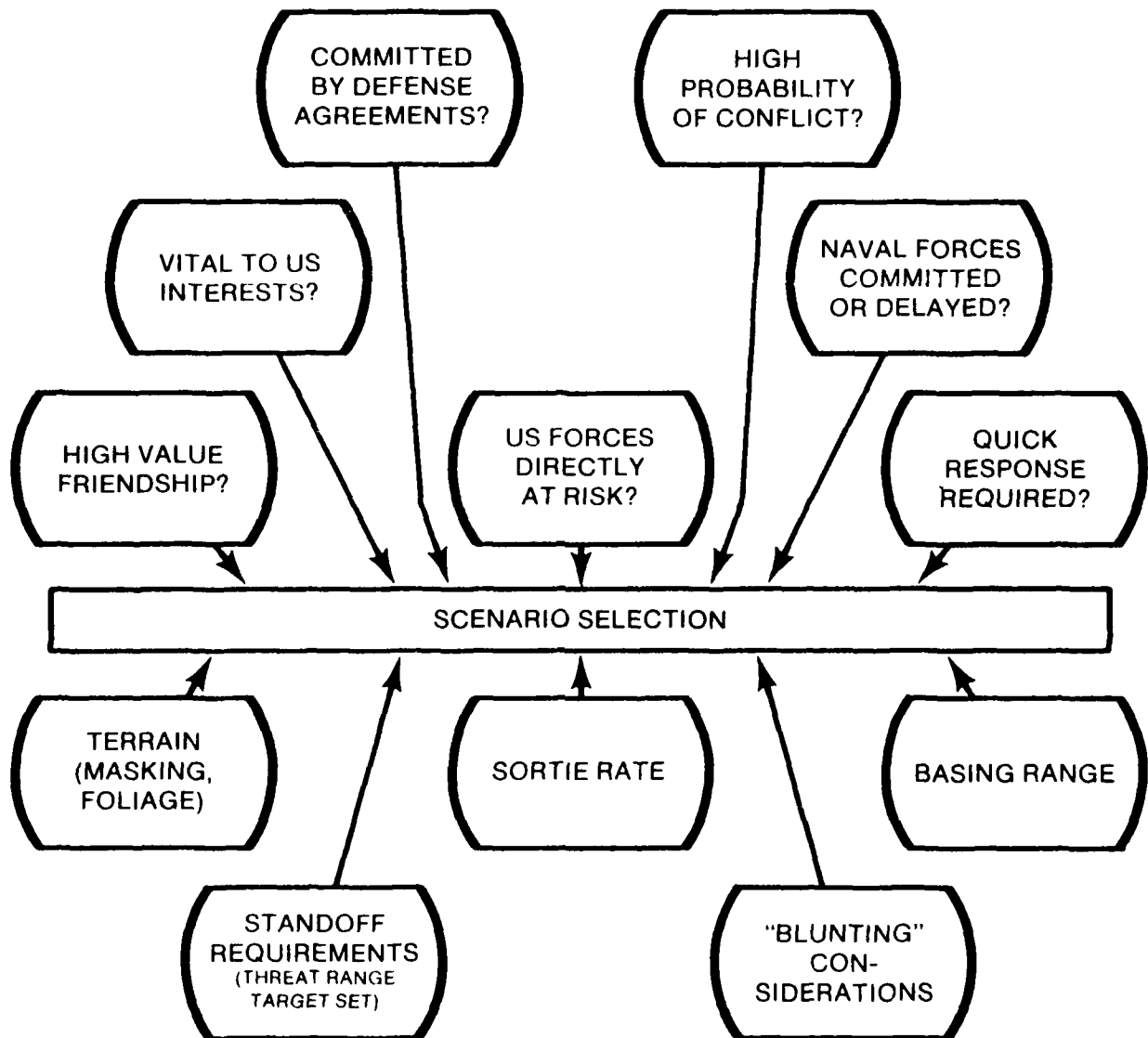
It is assumed that there will not be a Soviet-US nuclear exchange or large-scale conventional war in Europe. Our nuclear deterrent force has been effective, and diplomacy has prevailed in negotiations with the Soviets and Warsaw Pact countries. Further, it is assumed that a B-52G DCBF has been established, that is equipped with improved sensors and standoff weapons both of adequate capability and range to stay outside the defenses in the target area. The sensors would have SAR, ISAR, MTI, and FTI capabilities. The standoff weapons would be generic types that could be "launch and leave" or could require midcourse guidance from the bomber. Next, it is envisioned that the DCBF would only be used as an instrument to "blunt" an attack until other forces could be deployed. It is not intended for sustained operations. Once other forces arrive, they would revert to more conventional support and cooperative strike as the tactical situation permits. Finally, the will or resolve of the United States to deploy and employ these forces is unquestioned.

Many factors must be considered when evaluating a scenario. It is not germane to this study to discuss these factors in detail. But Figure 6-12 will give you an appreciation of the complexity in developing scenarios.

Conflicts for a DCBF can be divided into two basic mission types: land or maritime. The land conflicts could vary in intensity from low to medium to high, depending on the number of forces required and the defensive threat environment. The maritime mission could also vary in intensity, depending on the role (search and surveillance, mine laying, or antishipping) and level of conflict. But all naval scenarios will be classified under just "maritime." A maritime tasking would generally result from some type of land situation, so the two are many times related and would require dual capabilities. Some possible scenarios are listed below according to their respective type of conflict and level of intensity.



FIGURE 6-12. FACTORS TO CONSIDER IN SCENARIO SELECTION



## LAND CONFLICTS

<u>Low Intensity</u>	<u>Medium Intensity</u>	<u>High Intensity</u>
Libya-Chad	Vietnam-China	North Korea-South Korea/US
South Yemen-North Yemen	Ethiopia-Somalia	Syria-Israel/US
Libya-Tunisia	Iran-Iraq	USSR-Iran/US
Nicaragua-Panama	Iraq-Kuwait/Saudi	Warsaw Pact-NATO
South Yemen-Oman	Arabia/US	USSR-Turkey/US
Algeria-Morocco	Angola-Zaire	Vietnam-Thailand/US

## MARITIME

India/USSR-Pakistan

Syria-Lebanon

Of the scenarios listed above, two were selected as representative of good prospects for DCBF employment. These scenarios were Iraq versus Kuwait/Saudi Arabia for the land conflict and India/USSR versus Pakistan for a maritime situation. Both of these scenarios have been analyzed throughout the Department of Defense and by aerospace contractors and "study houses" across the country. Therefore, much comparative data was available to insure validity. Let us look at the land conflict first.

Iraq versus Kuwait/Saudi Arabia. The Iraqi government is under great pressure. Iraq is still engaged in a stalemate battle with Iran on the eastern border and is suffering from disenchantment within its political structure over domestic policies. A faltering economy, due to the Iranian war and OPEC pricing policies, and deteriorating relations with Saudi Arabia are creating even more problems. With their backs against the wall, the Iraqi forces are ordered to invade Kuwait and the oil-rich fields of Northeast Saudi Arabia. This invasion is intended to meet three of Iraq's problems: Increased revenue from captured oil fields, the probable downfall of the monarchy in Saudi Arabia after their loss of oil revenues, and finally a "status" victory within their own country. The Soviets have been quietly supporting and encouraging this action, even though they have no forces engaged in the effort. They do assist Iraqi planners in developing invasion plans and tactics. Timetable calls for completion in five to seven days.

The Iraqi invasion is a two-phase, two-pronged attack. (See Figure 6-13.) Phase one calls for the fifth motorized rifle division (MRD) and the sixth tank division (TD) to drive through Kuwait in minimum time. The fifth MRD swings south and east to capture Kuwait City and Kuwait International Airport by the end of day 3. The sixth TD speeds south and splits off to the west to capture the pipeline road, while the fifth MRD takes Kuwait International airport. After the objectives of phase one are accomplished, the fifth MRD heads south along the coast, and the sixth TD drives east along pipeline road to join forces and capture or destroy the oil fields of northeast Saudi Arabia. If the plan is successful, all of Kuwait's and 70 percent of Saudi Arabian oil-producing facilities have been captured or destroyed.

The combined forces of Kuwait and Saudi Arabia are inadequate to stem the Iraqi advance until too late. The invasion could not be stopped until day 9 of the conflict. This is a difficult situation for the free world's oil supply. Is there another alternative to the outcome of this scenario? Yes. Most definitely. The intervention of the DCBF could alter this outcome significantly.

The DCBF could be deployed to forward bases at the first indication of increased tensions and could maintain airborne (armed) surveillance missions and determine when Iraq forces were gathering for an attack. The show of force alone might be sufficient to discourage the attack. If not, then the DCBF could attack with standoff weapons the armor and POL supplies of the invading forces as they crossed into Kuwait territory. (This same operation could be carried out from SAC bases in the CONUS. The missions would only be larger and more demanding because of the human factors.) The Iraqi attack could be blunted before the fall of Kuwait City, thereby allowing our RDF to land at Kuwait International Airport. With the DCBF, the RDF, and land-based TACAIR supporting Kuwait and Saudi Arabia, the oil-producing facilities of both countries would remain intact and available to the free world.

What measure of merit (MOM) do we use in determining the utility of the DCBF in this scenario? We could approach the problem in two ways. We could attack and destroy the armor vehicles themselves or destroy the POL supplies they would need in order to keep advancing. The Soviet-trained commander of the attacking force would not give orders to attack if fuel reserves were below 50 percent of their normal level. Likewise, the destruction of 30 percent of an armor force is usually considered sufficient to stop an armor attack. The DCBF, with appropriate standoff weapons and sensors, could accomplish either or both of those objectives in the Iraqi-Kuwait/Saudi Arabia scenario and could maintain a virtual "zero" attrition rate for the DCBF. With forward basing, this "intrusion" could be initially "blunted," using POL as a MOM by a small, fully equipped DCBF of only 18 B-52Gs, flying only 47 sorties, and launching 444 standoff weapons.<sup>52</sup> A small force with a big payoff. So much for the land battle. How useful would the DCBF be in a maritime scenario? Steaming down the Persian Gulf through the Gulf of Oman, we arrive at the Arabian Sea adjacent to the shores of our next place of interest, Pakistan.

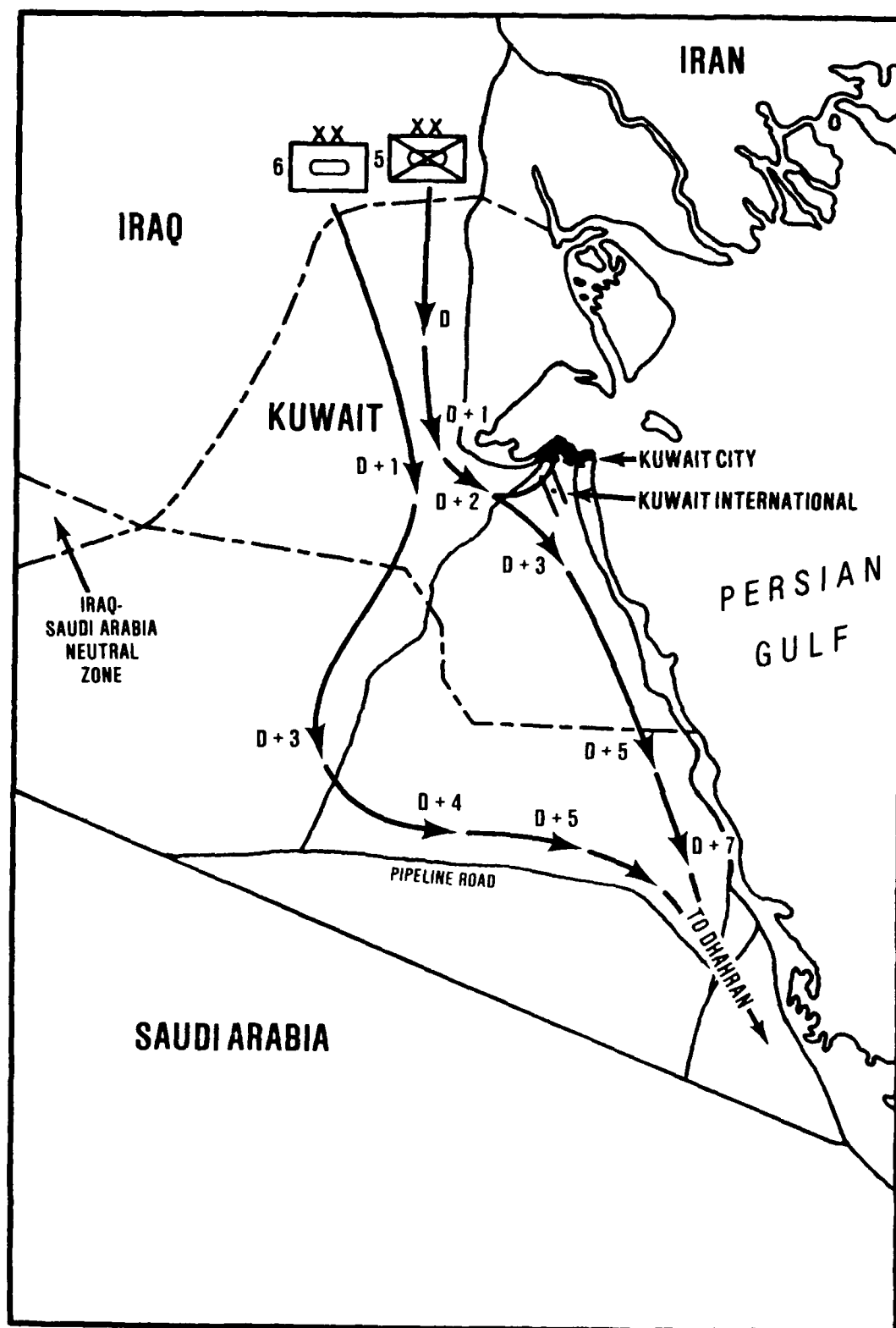


FIGURE 6-13. IRAQI INVASION PLAN

India/USSR versus Pakistan. This scenario is typical of how a third world situation could propagate the use of the DCBF in a maritime role. The timing of the scenario is such that only one US carrier task force is remaining on station in the Indian Ocean area. All other US naval forces have been diverted to counter increased Soviet naval activity in the Mediterranean, the Pacific, and the North Sea area. This Soviet ploy has been expertly timed to coincide with a border dispute and deteriorating relations between India and Pakistan. The United States seeing the increased tensions and realizing that the US fleet has already been tasked with monitoring the Soviet fleet in the Indian Ocean, take precautionary measures and deploys 13 B-52Gs of the DCBF to Ras Banas, Egypt, and 13 more to Diego Garcia. The DCBF can then support the Navy in sea lane patrol and surveillance of shipping movements. The stage is set.

India's ground forces are massed along the southern border east of the port city of Karachi, Pakistan. Four Soviet divisions are ready to press across the Pakistani border to Afghanistan. Simultaneous attacks are launched by Indian and Soviet ground forces, both aimed toward the Port of Karachi. (See Figure 6-14.) The Soviet objective is to overrun Pakistan before the United States can react, thereby cutting off sanctuaries for Afghanistan guerrillas and acquiring warm water ports on the Indian Ocean with overland access. Control of these ports could be a further springboard for the projection of Soviet power. The Indians are under the impression that after this conflict is over, they will once again be a reunited country. Pakistan asks for US intervention with ground forces. The United States immediately airlifts a brigade of the RDF to help defend the port of Karachi.

The Pakistan navy is small and cannot stand up to the Indian navy without assistance. Their primary concern is patrolling the southern shoreline. The Indian fleet is on station in the northeastern part of the Arabian Sea, while the Soviet fleet is observing (but not engaged in the activities) from just outside the Gulf of Aden. (See Figure 6-15.)

The US Navy commander is faced with multiple tasks. Supply efforts for US forces in Pakistan must come primarily from the sea. He must provide protection for these supply convoys, assist the Pakistani navy, monitor both the Soviet and Indian fleets, and react if they intervene. It is obvious that the US fleet has insufficient forces present to do all of these tasks simultaneously. Here is where the DCBF can be of great assistance in the maritime mission.

The DCBF, equipped with sensors that have SAR, ISAR, MTI, and FTI capabilities, can detect, select, classify, and identify any ship passing within its patrol corridor. (See Figure 6-16.) If US or Pakistani ships are threatened, the DCBF has the authority and capability to attack. Armed with appropriate long-range, conventional standoff

# INDIA-SOVIET INVASION PLAN

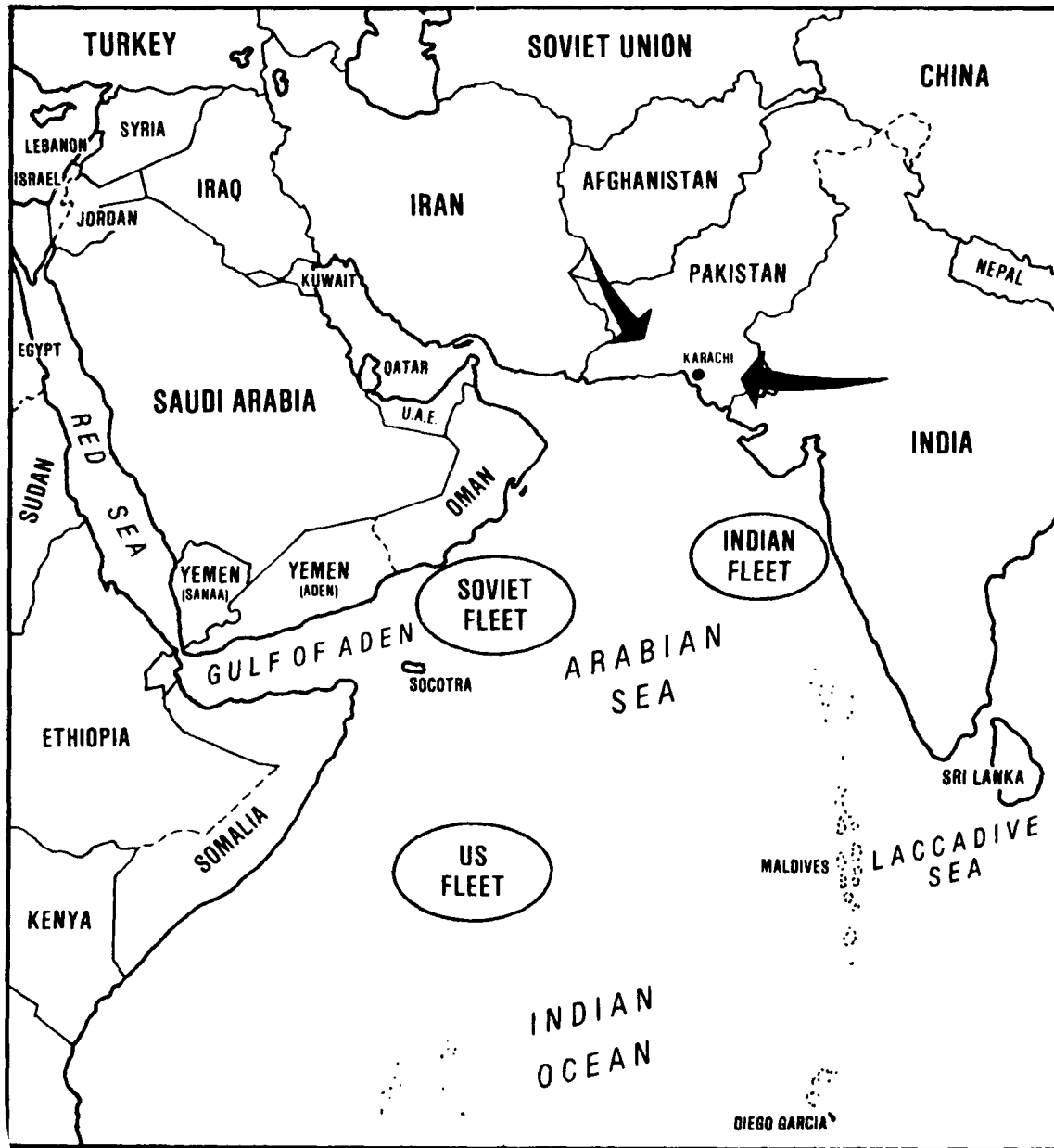
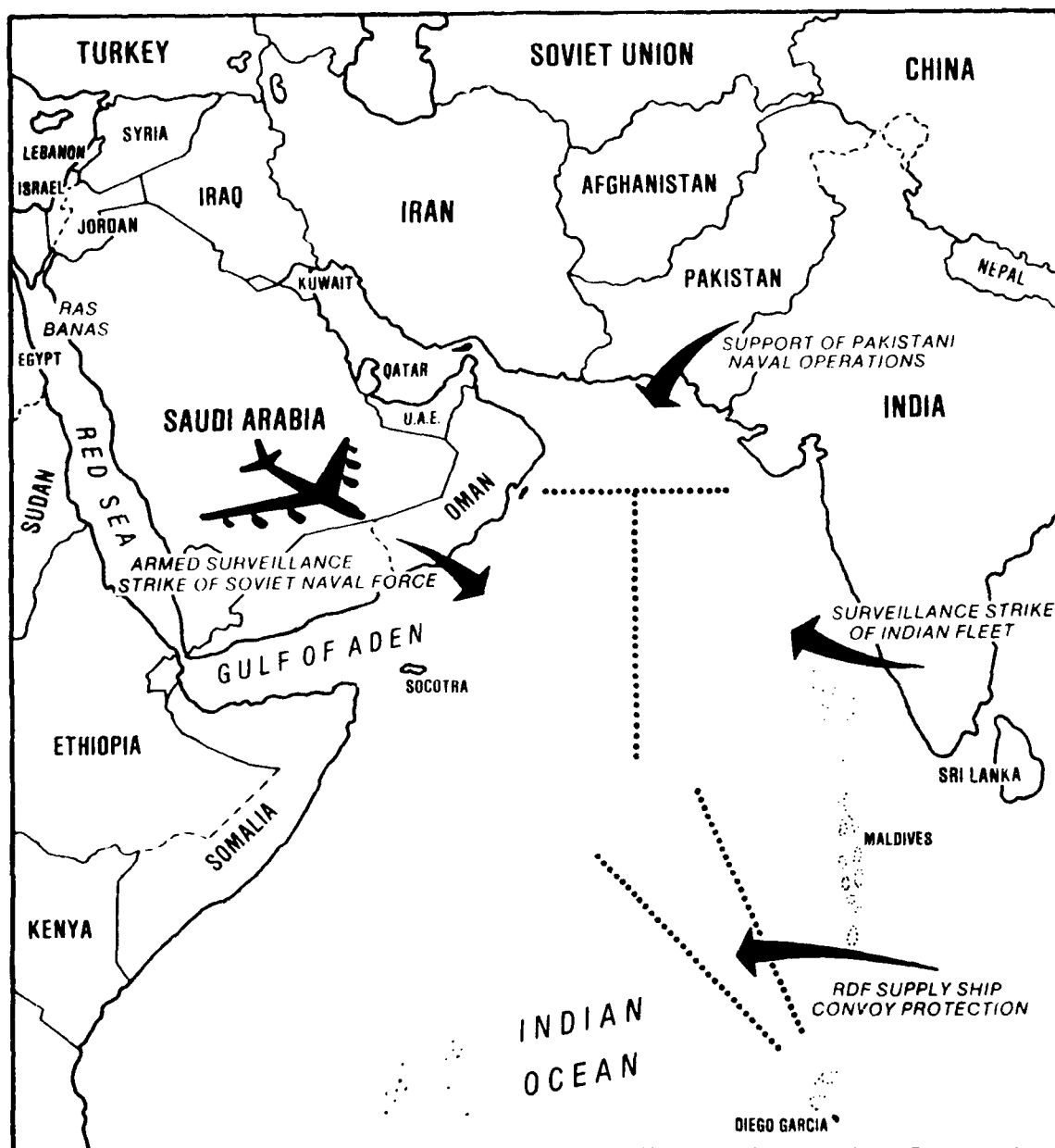


FIGURE 6-14



**FIGURE 6-15**  
**DBF OPERATIONAL REQUIREMENTS FOR ARMED SURVEILLANCE/INITIAL STRIKE IN MARITIME ROLE**

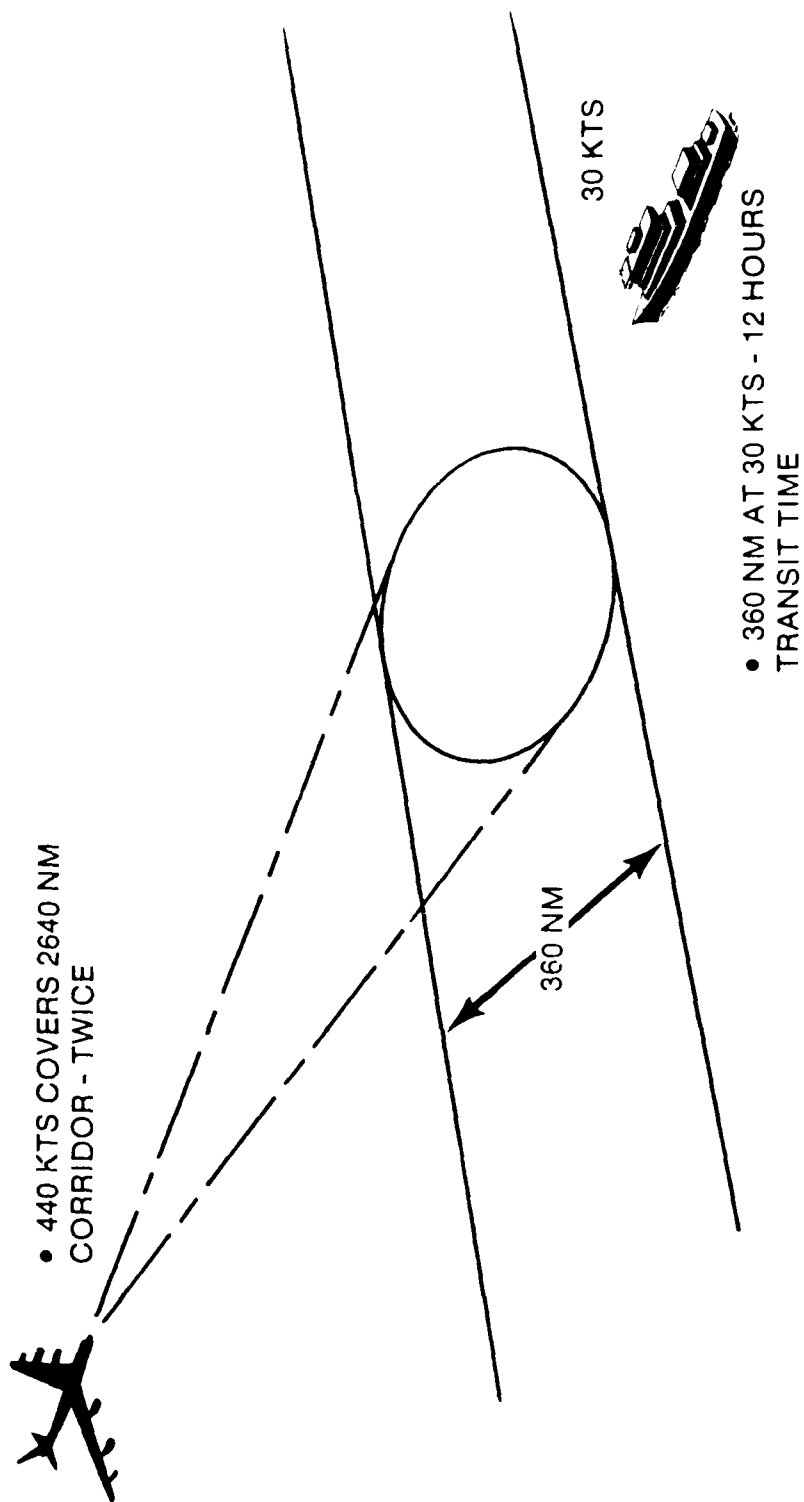


FIGURE 6-16. CORRIDOR PATROL AND ARMED SURVEILLANCE



weapons, the DCBF can target and attack from outside the lethal defense radius of Soviet or Indian naval forces. While maintaining a virtual "zero" attrition rate, the DCBF can significantly assist in sea control. Broad ocean surveillance, escort of supply ships, and aerial mining are only a few of the DCBF's capabilities. If appropriately equipped, the DCBF could defeat both the Indian and Soviet fleets and positively affect the outcome of the invasion of Pakistan.

We could discuss and analyze many other scenarios in more detail, but these two scenarios should give you an indication of the value of a properly equipped DCBF to both our rapid deployment and maritime capabilities. The force application is very flexible and would be equally effective in low-intensity or high-intensity conflicts.

### Summary

The technological pendulum is swinging away from the United States and toward the Soviet Union. Just as we can stop the pendulum on a clock, we can stop the technological shift by "grabbing on" to this concept of using strategic bombers in conventional roles. The application of the brightest minds in this country to the development and production of improved sensors and standoff weapons can repay us many times over if we ever need to employ them in combat.

Our existing forces are neither highly survivable nor effective in the conventional force projection or maritime roles. The strategic bomber force has been declining for the past 20 years and is now at an all time low. Economic considerations are precluding a return to the higher force structures in bomber and fighter aircraft. We must insure that we do everything possible to give what forces we do have leverage and equipment or systems that will provide a multiplier effect on our constrained force structure. The technologies required are available.

Consideration of the establishment of a dedicated conventional bomber force consisting of our B-52Gs appears to be an economical way to proceed. The sensors are available and the weapons could be produced with extremely long standoff ranges. The old accuracy question on standoff weapons is now a moot point. With sophisticated electronics, micro-processing, and improved weapons navigation systems, we no longer have to discuss accuracy as a function of range.

There are many areas of potential conflict in the world today, but as we saw in our employment scenarios the DCBF, with new sensors and weapons, can be a decisive factor in almost any conventional conflict. The Navy needs help in the maritime mission, the RDF needs time to get its forces in place, and we must develop truly, rapid force projection while managing attrition in an increasing threat environment. A small but powerful conventional bomber force could mean a big return. New ideas, new technologies, and new capabilities are all waiting to be expanded and developed. The decision is ours to make.

## NOTES

### CHAPTER VI

1. Perry, William J., "Significance--Greater than Radar," Military Electronics/Countermeasures, January 1979, p. 45.

2. Verne Orr and General Charles A. Gabriel, USAF, Fiscal Year 1984 Air Force Report to the 98th Congress, a joint statement, p. iv.

3. Air Force 2000, (Washington, D.C.: Headquarters USAF, 1982), p. 244. (Note: All references are unclassified.) Secret.

4. Ibid., p. 245.

5. John M. Collins, US-Soviet Military Balance--Concepts and Capabilities 1960-1980 (New York: McGraw-Hill Publications Company, 1980), p. 105.

6. Ibid., p. 106.

7. Ibid., p. 107.

8. Air Force 2000, pp. 16-19.

9. R. V. Jones, "Future Conflict and New Technology," The Washington Papers/88, vol. IX (Beverly Hills/London: Sage Publications), pp. 41-53 and pp. 61-63. These sections outline the basic technologies, weapons, and techniques applicable to open conflict. Highly recommend reading the entire report.

10. Clarence A. Robinson, "DeLauer Urges Technology Spending," Aviation Week and Space Technology, 6 September 1982, pp. 257-263. Reports results of a Defense Science Board recommendation on technological candidates that could provide an order of magnitude in weapon advances for the United States.

11. United States Military Posture for FY 1983, prepared by the Organization of the Joint Chiefs of Staff (Washington, D.C.: US Government Printing Office, 1983), p. 63.

12. Caspar W. Weinberger, Annual Report to the Congress, Fiscal Year 1984 (Washington, D.C.: US Government Printing Office, 1983) pp. 46-47.

13. Ibid., pp. 47-48.

14. Orr and Gabriel, p. 17.

15. Weinberger, p. 17.
16. Orr and Gabriel, p. 17.
17. US New and World Report, "The Saudis: How Much Help for US Peace Plan," 94, no. 18 (9 May 1983):45-46.
18. Weinberger, p. 192.
19. United States Military Posture for FY 1983, p. 9.
20. United States Military Posture for FY 1984, prepared by the Organization of the Joint Chiefs of Staff (Washington, D.C.: US Government Printing Office, 1983), p. 9.
21. James D. Hessman, "Dangerous Dependence on Foreign Minerals," Air Force Magazine 94, no. 9 (September 1981):141.
22. Ibid., p. 141.
23. General Alton D. Slay, USAF, "The Air Force Systems Command Statement on Defense Industrial Base Issues," a hearing before the Industrial Preparedness Panel of the House Armed Services Committee of the House of Representatives, 13 November 1980, p. III-1.
24. Hessman, p. 143.
25. United States Military Posture for FY 1983, p. 9.
26. William J. Taylor, Jr., "The Future of Conflict," The Washington Papers/94, vol. X, CSIS (New York: Praeger Publishers, 1983), p. 11.
27. "The Military Balance 1982/83, Latin America," Air Force Magazine 65, no. 12 (December 1982):134.
28. "What the Next 50 Years Will Bring," US News and World Report 94, no. 18 (9 May 1983):A12.
29. United States Military Posture for FY 1983, p. 12.
30. Ibid., p. 13.
31. Weinberger, p. 17.
32. "With His Back Against the Wall," US News and World Report 94, no. 18 (9 May 1983):30.
33. Weinberger, p. 192.

34. Taylor, p. 17.
35. Ibid., p. 74.
36. Richard M. Nixon, The Real War (New York: Warner Brothers Books, Inc., 1980), p. 165.
37. Stefan T. Possony, Strategic Airpower: The Pattern of Dynamic Security (Washington, D.C.: Washington Infantry Press, 1949), p. 15.
38. Ibid., p. 15.
39. AFM 1-1, Functions and Basic Doctrine of the United States Air Force (Washington, D.C.: Department of the Air Force, 1979), p. 1-7.
40. Webster's Third New International Dictionary of the English Language, Unabridged (Springfield, Mass.: G & C Merriam Company, 1976), p. 2256.
41. JCS Publication 1, Department of Defense Dictionary of Military and Associated Terms (Washington, D.C.: US Government Printing Office, 1979), p. 328.
42. General Charles A. Gabriel, USAF, "Open to New Ideas," Air Force Magazine 65, no. 9 (September 1982):102.
43. Data for this chart was extracted from Secretary of Defense, Caspar W. Weinberger, Annual Report to the Congress, Fiscal Year 1984 (Washington, D.C.: US Government Printing Office, 1983), pp. 223-224. All transition points, where change of roles, retirement, or initial deployment are indicated, are approximate and should be very flexibly interpreted. Future economic considerations/decisions could radically alter this force structure.
44. Air Force 2000, pp. 16-19.
45. USAF Fact Sheet, "E-3A Airborne Warning and Control Aircraft," Headquarters USAF/Office of Public Affairs, December 1981, pages unnumbered.
46. Air Force Contributions to Mutual Reinforcement-Collateral Function Capabilities, Headquarters USAF, 1976, pages unnumbered. (This brochure was prepared by the US Air Force in cooperation with the US Navy.)
47. Edgar Ulsamer, "C<sup>3</sup> Survivability in the Budget Wars," Air Force Magazine 66, no. 6, (June 1983):41-42.

48. "Conventional Standoff Capability" (Wichita, Kans.: Boeing Military Airplane Company, 1982), last page, unnumbered. (This document was the result of a technical interchange meeting conducted 9-10 December 1982; OSD and Air Force personnel attended.)

49. John W. R. Taylor, "Jane's All the World's Aircraft Supplement," Air Force Magazine 65, no. 12 (December 1982):162.

50. Charles J. Kelley, Jr., "Future Forces For Third World Contingencies: A Briefing," Rand Corporation, December 1982.

51. Information received in a briefing from Billy G. Nix, "B-52 Conventional Standoff Capability (CSC)," prepared by Boeing Military Airplane Company, 26 April 1983, pages unnumbered.

52. For the interested reader a detailed analysis of how the measures of merit, force size, sorties, and missiles required can be found in the phase III TIM Report, "Conventional Standoff Capability," prepared by Boeing Military Airplane Company, Wichita, Kans., 9-10 December 1982.

## CHAPTER VII

### DECISION TIME

The words "decision time" seem to have a paralyzing effect on our intellectual functions. They imply no more studying, no stalling, no delaying until tomorrow, and no more moving the issue to the "too hard to handle" file. The words indicate we must make a decision now. Time has run out. We are also at that point in the investigation of new technology weapons, and how they might affect future employment of strategic bombers in conventional conflicts.

Decisions must be made that are very difficult and complex. Those decisions encompass more than just SAC force structure or the development of new weapons. What we really are facing is whether the United States has the capability to respond in a timely manner to a crisis at some level below a nuclear exchange. Translated into the framework of this study, that issue becomes the question: Do we have a truly rapid, responsive, and effective conventional force projection capability? The answer to that question is an unqualified we could have. As pointed out previously, we have the bomber force structure, technology, and weapons within our reach to do the job. We simply must make the decision to combine these individual parts into an integral and effective conventional bomber strike force. We must have a force that can give the national command authorities some military options at the lowest possible levels of conflict to insure the survivability of the forces employed.

If the decision is made to develop this conventional bomber force, another question arises. Do we have time? Air Force Chief of Staff General Gabriel, placed the time issue in perspective in a recently published article.

In September 1939, the Air Corps had only 800 first-line aircraft, while Germany had more than 4,000 aircraft of better quality. The one exception was our B-17, which was better than the German bombers of that time, but we had only 23 on hand. We may never again have the luxury of two years or more to change the equation, as we did then.<sup>1</sup>

How much time do we have? A speaker at the Air War College in response to a similar question replied, "Tell me whether it is 1939 or 1943, then I can give you an answer." The point being, we do not know if we have time or not. Therefore, we need to be ready as soon as possible with a responsive and capable conventional force projection capability to match our national strategy. It is decision time. With that sense of urgency in mind, a few observations or conclusions derived from this study and associated research may be in order. Because new technology is a key issue of this study, it is an appropriate area with which to conclude this effort.

### Technology Explosion

A technology revolution is in progress. We have only seen a tip of the iceberg in our discussion of the weapons and systems of today. Advances in technology are changing the way in which wars will be fought in the future. As pointed out in our discussion of the Falklands and Lebanon conflicts, we have only seen a sampling of technology in warfare and how it can dramatically affect the outcome. Wars will continue to be fought in spite of advances in technology, but they will be fought with newer, more lethal, sophisticated weapons. If we are to remain a factor in the world-power equation and committed to insuring freedom for peace-loving people, then we must be willing to accept some of the risks involved in acquiring these new technologies. That means a commitment to turn into actual hardware the sensors, long-range standoff weapons, weapons-guidance navigation system, and the "smart" submunitions that we have in the laboratories today. There are no technological miracles required to make these systems work. Only perseverance and financial commitment are required. Technology can provide the weapons that will give us rapid and effective force projection capability, one that will fulfill our national strategy. The development of long-range conventional standoff weapons is the key to achieving that capability. Richard N. Perle, Assistant Secretary of Defense for International Security, concludes our observations of technology with this thought:

There are new technologies on the horizon that can make great improvements to raise the nuclear threshold by more effective conventional weapons. [He singled out] our technical capability to build guidance systems for cruise missiles that can deliver munitions over any range--they are in fact range-insensitive--in all weather, day or night with three-meter target accuracy.

We need to think this through in a doctrinal sense because for a whole class of targets that heretofore needed nuclear weapons we now can use conventional munitions.<sup>2</sup>

### Observations on Weapons Acquisition

The length of time required for the development of new conventional weapons must be reduced. The current 8-to-10-year development cycle is simply unacceptable. There are many reasons for this long development period but the primary reasons are inadequate funding of the technology base and no firm long-term commitment to an Air Force conventional munitions acquisition plan. We need an organized, coordinated Air Force conventional weapons program that addresses the conventional requirements of strategic bombers and tactical aircraft. Commonality in this program could be the ingredient to success. The yearly budget cutting exercise, where our conventional munitions programs are likely to be reduced, needs revision. The on-again, off-again approach to weapons development severely hampers our ability to field new technology conventional weapons.

New weapons are needed for the maritime mission as well as land attack role. An extended range Harpoon or an antiship MRASM would allow the bomber to exploit the full standoff range and detection capability of the AWACS or the bomber's own improved sensor system.

Increased emphasis on a conventional weapons development program may be as essential to our war-fighting capability as modernizing our strategic bomber forces. The newer bombers, the B-1B and ATB, will face the same defensive threats in a conventional conflict as do our older B-52s. This is true as long as we force them all to deliver World War II vintage gravity weapons. We need to make all of our bombers capable of participating in a conventional conflict without reservations or concern about the loss of this limited national asset. A small bomber force structure makes survival a key consideration.

#### Observations on Bomber Force Structure

Because of economic and political considerations, the strategic bomber force structure and modernization plans are just about "set in concrete" until the end of this century. Increasing economic pressures will preclude us from altering significantly the current two-bomber acquisition program. Our penetrating manned bomber force will be small and relatively expensive per aircraft. (100 B-1Bs and an unknown, but probably limited, number of ATBs.) The same cost considerations exist for the remaining B-52Gs and B-52Hs as they are "finite" assets and cannot be replaced; therefore they are priceless. We must seek ways for this bomber force to operate in conventional roles while it is faced with the potential of a highly lethal enemy defensive system. The attrition picture does not look good for either bomber or fighter aircraft if they deliver gravity weapons requiring target overflights. Even the low historical attrition rates of previous wars (roughly two percent) are unacceptable when working with such small numbers. We need to seek improved ways to avoid the attrition problem and increase the operational effectiveness of each individual sortie. The new technology standoff conventional weapons described in Chapter V could provide a starting point for a solution to this problem.

If these new technology weapons are developed, they could change our approach to the traditional roles and missions of the strategic bomber. Using only the strategic bomber assets that are now on the ramp, we could effectively equip and employ a dedicated conventional bomber force (DCBF). This force, as proposed, would consist of approximately 61 B-52Gs (PAA), equipped with new sensors and new technology weapons, and could perform the rapid deployment mission or the maritime support role. Because of the DCBF's increased effectiveness and autonomous capability, fewer sorties would be required to accomplish the mission objective. This would allow the small but powerful force to handle simultaneous conflicts with sufficient firepower to turn the tide shortly after the initiation of hostilities. The cost to develop a DCBF is not prohibitive and could provide a high payoff if we need to



use it. A permanent decision needs to be made on the future of the highly capable B-52s, and then we need to develop a force to meet our stated national objectives.

### A Modern Maginot Line

The development and employment of these new technology conventional standoff weapons could make AAA, SAMs, and even most airborne interceptors ineffective against the bombers of a DCBF. The vast majority of these expensive defensive systems would "stay in their trenches," while we "outflanked" them with long-range, highly accurate weapons. Many of the defensive systems, especially the fixed site SAMs which are the most capable and lethal defenses (SA-5s), could themselves become targets for these new weapons. However, there is no need to attack them if they do not have an impact on the mission. Truly a modern Maginot Line. An interesting thought, but a few words of caution.

Technology has provided us with the "ultimate weapon" since time immemorial. But technology is a fickle friend. Just as soon as the new weapon brings an advantage to the offense, technology provides an answer to neutralize that advantage. As long as we understand that fact, the real potential can be seen. These new technology conventional weapons and systems will buy us time. How much time? A difficult question. However, if peace can be maintained or if only one potential conflict is avoided because of this strength, it would be enough. The perception of strength and the resolve to use that strength will deter conventional conflicts, just as it has for the past 38 years in the nuclear arena. General Gabriel inculcates these thoughts for us:

As America has shown so many times in the past, we have the will, the ingenuity, and the resources to do what is necessary to maintain our power and, thus, preserve the peace. Strength does not invite war--weakness does.<sup>3</sup>

### Future Directions

This study has addressed a wide range of perspectives on the future participation and potential of strategic bombers in the conventional arena. The topic has been viewed from as many directions as possible: a review of historical usage of strategic bombers, our current directions in policy and guidance, an introduction to potential attrition in future wars by looking at recent conflicts, a weapon's survey emphasizing some of our existing and new technology developmental weapon systems, investigation of potential areas of involvement, our current and projected bomber force structure, and finally an attempt to put it together and see what it all means. So what have we learned? An old saying states: Nothing is as simple as it looks. That is especially true when we contemplate the use of US strategic bombers in a conventional role.

The future outlook for pursuing new technology weapons and improving the Air Force capability to react in sufficient time with adequate firepower to stop or blunt a conventional ground attack or maritime force anywhere in the world is not like a superhighway where we can effortlessly cruise along to our destination. It is more like a dirt road in Oklahoma after a heavy rain. A slippery road, full of ditches to slide into, potholes and rocks to dodge. Some of these "obstacles" we have to avoid are those that involve military force structure issues, funding constraints, blending of traditional tactical and strategic roles, and finally service parochialism and institutional resistance to change. General Gabriel succinctly commented on these last two issues at a recent Air Force Association symposium.

Change--in particular, significant change--isn't an easy thing to accomplish. Bringing it about requires sacrifice, struggle, and strong convictions. The process is a tough one which requires that we not throw out the baby with the bath water--that we preserve the important things we already have as we discard outmoded concepts and parochial ideas. We can't mortgage the present for the future or the other way around.<sup>4</sup>

Even with those obstacles in our path, we can still make some valid observations on the impact of new technology weapons on SAC conventional air operations.

The strategic bomber, properly equipped and armed with new technology weapons, can be a decisive factor in a conventional land attack or maritime force projection role. It is not the only weapon system with which these battles could be fought, but it may well be the only one that we can afford and that we could get to the conflict area in time. If we decide to acquire this new conventional capability, some concepts of aerial warfare will be altered, but we will continue to conduct operations and fight in the traditional sense. A powerful strategic conventional bomber force will not change our nuclear force capability, but it will serve as a strong complement to our nuclear force capability in maintaining peace across the spectrum of conflict. The only remaining question is whether we are willing to proceed. The decision we make could be critical to the security and defense of our country.

As a final thought, I would like to quote General Bennie L. Davis, Commander in Chief, Strategic Air Command, who states a philosophy to which all men should adhere:

No sane man, military or civilian, wants war . . . but if war is forced upon us, we want the war-fighting capability to set a price on our opponent's objectives that he cannot afford to pay. . . .<sup>5</sup>

And now it is decision time.

## NOTES

### CHAPTER VII

1. General Charles A. Gabriel, USAF, "From Silk Scarf to Spacecraft," Air Force Magazine 65, no. 11 (November 1982):82.
2. Richard N. Perle, as quoted by Edgar Ulsamer in "Technology, Politics, and the Global View," Air Force Magazine 66, no. 2 (February 1983):100.
3. Gabriel, p. 83.
4. As quoted by Edgar Ulsamer in, "The Finite Lists of Affordability," Air Force Magazine 66, no. 1 (January 1983):78.
5. General Bennie L. Davis, USAF, "Strategic Air Command," Air Force Magazine 66, no. 5 (May 1983):100.

## APPENDIX A

### EXPANDED INFORMATION ON SOVIET LAND-BASED SAMS

Appendix A provides a more detailed description of the known Soviet SAM systems. The unclassified data for these systems is difficult to obtain and highly speculative. Depending on the source, we can obtain a widely divergent set of numbers for effective range and altitude. The data presented here is in most cases a consensus from multiple sources. Therefore, the values should not be taken as absolute. The NATO identification for each SAM is shown in parentheses following its designator, for example, SA-1 (Guild).

#### SA-1 (Guild)

The SA-1 is not mobile or transportable and is one of the older SAM systems used primarily by strategic air defense units. SA-1 units have been deployed around the city of Moscow in two concentric rings since 1954.<sup>1</sup>

#### SA-2 (Guideline)

The SA-2 is widely used by the Soviet defense forces, the Warsaw Pact forces in particular, and by many Soviet allies and friends. The missile is command-guided by various types of radar and employs either high explosive or nuclear warheads.<sup>2</sup> The Guideline is an effective medium to high-altitude system with a slant range of about 27 miles and an effective altitude between 1,000 and 80,000 feet, depending on the specific system.<sup>3</sup>

#### SA-3 (Goa)

The SA-3 is also widely used by Soviet forces and typically complements the SA-2 system. It is a road-transportable, solid propellant, command-guided missile and is effective at low and medium altitudes.<sup>4</sup> It also employs either high-explosive or nuclear warheads and has an effective slant range of about 15 miles.<sup>5</sup>

#### SA-4 (Ganef)

The SA-4 is a mobile SAM system, twin mounted on a tracked carrier. It employs a solid propellant booster and a ramjet engine. The missile is command guided and employs a high-explosive warhead.<sup>6</sup>

#### SA-5 (Gammon)

The SA-5 is not mobile and is generally characterized as a strategic defense system. It is an example of the long-range, high-altitude SAM threat that could be encountered over high-value-point targets. The SA-5 is a semiactive radar homing missile with an effective range of 250 kilometers (about 135 NM) and an altitude of about 29 kilometers (over 90,000 ft).<sup>7</sup>

#### SA-6 (Gainful)

The SA-6 is a command-guided and semiactive radar homing SAM with an optional optical tracking capability. It is fully mobile and deployed with air defense elements of the Soviet ground forces, Warsaw Pact, and other nations, such as Libya, Syria, and Vietnam. The propulsion system is an integral rocket/ramjet with a speed capability of about Mach 2.8. Lateral range extends out to 60 kilometers at high altitude and 30 kilometers at low altitude. The SA-6 can engage targets between 13 kilometers and 4 kilometers in altitude. It packs an 80 kilogram high-explosive warhead, detonated by impact, proximity, and command fuzing.<sup>8</sup>

#### SA-7 (Grail)

The SA-7 system is a man-portable, shoulder-launched infrared homing missile. It is employed by troops in motorized rifle, airborne, and tank regiments and is used for low-altitude, short-range, line-of-sight defense.<sup>9</sup> Approximate range is 9 to 10 kilometers. The overall missile concept is similar to the US Redeye system.<sup>10</sup>

#### SA-8 (Gecko)

The SA-8 has been described as the Soviet version of the Roland system because of its similarities in operational philosophy and characteristics. It is highly mobile and is employed as a forward-air-defense system. The SA-8 is postulated to employ command guidance as well as semiactive radar and infrared homing in the terminal phase. Each launcher has four mounted missiles and a carrying capacity for one additional reload (total of eight missiles per launcher). Maximum range is about 8 to 16 kilometers with a missile speed of about Mach 2.0.<sup>11</sup>

#### SA-9 (Gaskin)

The SA-9 appears to be a highly mobile, vehicle-mounted version of the man-portable SA-7 (Grail). It is employed for short-range, low-altitude defense. Experts think it has improvements over the SA-7 in propulsion, warhead, and control systems. Approximate range is 8 kilometers. The SA-9 is deployed with all Soviet and Warsaw Pact ground forces.<sup>12</sup>

#### SA-10

The SA-10 is the newest of the mobile Soviet SAM systems. It is reported to have remarkable performance at low and high altitudes, with a speed of Mach 5.0 and a turning acceleration capacity up to 100 g's. Effective range is estimated to be about 50 kilometers. Missile altitude envelope extends from 30 meters to 4,500 meters. Missile features suggest it employs active radar homing with three different types of radar for target detection, designation, and guidance.<sup>13</sup> SA-10 development was assessed to be a counter to cruise missiles and low-level intruder aircraft.<sup>14</sup>

#### SA-11

The SA-11 is a new SAM and is generally seen deployed alongside the SA-6. It could be an improved version of the SA-6. It is a Mach 3 missile with an estimated range of 17 miles. Its effective altitude is reported between 100 and 46,000 feet. The SA-11 is a mobile, tactical missile system.<sup>15</sup>

#### SA-13

The SA-13 is a highly mobile missile, track mounted and a replacement for the SA-9. It provides for defense of antiaircraft batteries of motorized rifle and tank regiments. It has a short range, approximately 5 miles, with an effective altitude of 165 to 32,500 feet.<sup>16</sup>

## NOTES

### APPENDIX A

1. Headquarters USAF, AF Pamphlet 200-21, Soviet Aerospace Handbook (Washington, D.C.: US Government Printing Office, 1978), p. 69.
2. Handbook on the Soviet Armed Forces (Washington, D. C.: Defense Intelligence Agency, 1978), p. 11-12.
3. AF Pamphlet 200-21, p. 69.
4. DIA Handbook, pp. 11-12.
5. AF Pamphlet 200-21, p. 69.
6. Ibid., p. 69.
7. R. T. Pretty, ed., Jane's Weapon Systems 1980-81 (London: Jane's Publishing Company, Ltd., 1980), p. 11.
8. Ibid., p. 75.
9. Ibid., p. 94.
10. DIA Handbook, pp. 8-25.
11. Jane's Weapon Systems, pp. 75-76.
12. Ibid., p. 76.
13. Ibid., p. 77.
14. Ibid., p. 211.
15. Air Force Magazine 66, no. 3 (March 1983):94.
16. Ibid., p. 94.

## APPENDIX B

### EXPANDED INFORMATION ON SOVIET SHIP-BASED SAMs

Format and comments presented here are the same as for Soviet land-based SAMs presented in Appendix A.

#### SA-N-1 (Goa)

It is the principal Soviet naval SAM system. The missile is identical to the land-based version, but the associated equipment is different. Over 66 SA-N-1 systems are fitted aboard Soviet vessels.<sup>1</sup>

#### SA-N-2 (Guideline)

The shipborne SA-N-2 is identical in performance to the land-based SA-2. Only one Soviet cruiser is presently known to carry the SA-N-2.<sup>2</sup>

#### SA-N-3 (Goblet)

The SA-N-3 is believed to be basically an improved shipborne version of the SA-3 (Goa) system. It has a range of 30 kilometers and can intercept targets between 150 meters and 25 kilometers. Later versions of the SA-N-3 Goblet installed on the Kiev and Kara class ships have an extended range of 55 kilometers. In all, over 40 systems are deployed on 21 Soviet ships.<sup>3</sup>

#### SA-N-4

The SA-N-4 is believed to be a shipborne version of the SA-8 (Gecko) tactical, land-mobile SAM. Its primary purpose is likely to be close-in air defense.<sup>4</sup>

#### SA-N-5

The SA-N-5 is a simplified air defense system for small ships. It uses SA-7 (Grail) missiles, and it has a range and altitude similar to the SA-7.<sup>5</sup>

#### SA-N-6

The SA-N-6 is a new missile deployed on the Soviet cruiser Kirov. Good data is not available on this system, but estimates indicate it to be a very sophisticated and capable system. This missile has an effective ceiling of at least 100,000 feet and effective range of about 37 miles. It has a high resistance to jamming.<sup>6</sup>



SA-N-7

SA-N-7 is a new missile on the Sovremennyy class guided missile destroyer. It is sophisticated, radar controlled. It is the naval equivalent of the SA-11.<sup>7</sup>

## NOTES

### APPENDIX B

1. R. T. Pretty, ed., Jane's Weapon Systems 1980-81 (London: Jane's Publishing Co. Ltd., 1980), p. 100.
2. Ibid., p. 100.
3. Ibid., p. 101.
4. Ibid., p. 101.
5. Air Force Magazine 66, no 3 (March 1983):94.
6. Ibid., p. 94.
7. Ibid., p. 94.

## APPENDIX C

### DOD RESEARCH AND DEVELOPMENT OF ELECTRONIC SYSTEMS

The information included in this appendix was extracted from a more lengthy article written by Joseph Feinstein,\* director of electronics and physical sciences, in the Office of the Under Secretary of Defense for Research and Engineering.

The emphasis of this study was on conventional technology weapons; therefore only those areas deemed applicable to this study were presented. You should find them interesting and informative. The wide range of mission needs emphasizes that there is still plenty of activity for the inventive electronics engineer.

For an excellent discussion of the many facets of electronics in warfare, I recommend the October 1982 issue of the IEEE Spectrum. This entire issue is devoted to "Technology in War and Peace." This issue is a valuable research document for anyone exploring advanced technology in warfare.

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\*Source: Joseph Feinstein, US Department of Defense, "Research Thrusts of the US DoD," IEEE Spectrum 19 (October 1982):91-93.

TABLE 1. Search and Surveillance

Search and surveillance is the detection of targets or potential threats at a range as long as possible.

Mission Need	Technical Approach
Battlefield surveillance amid adverse weather and manmade obscurants (dust, smokescreens, etc.)	Active illuminator laser radar or millimeter wave radar to augment passive IR sensors
Improved resolution of radar echoes	For transverse resolution synthetic aperture radar (SAR) and its inverse (ISAR) to provide a long interferometric baseline through uniform motion of the source or the target. Pulse compression for longitudinal resolution

TABLE 2. Target Acquisition and Fire Control

This phase of warfare involves the handoff from surveillance to target tracking, identification, and firing action.

Mission Need	Technical Approach
Target recognition	Collection of signature data on classes of targets, such as IR emissions and acoustic vibrations
Distinguishing real targets from decoys	Use of multiple sensors, such as dual or triple IR, optical, and millimeter wave  Three dimensional laser radar to provide depth characteristics
Intelligent munitions	Automated target recognition through the use of high-speed, real-time signal processing and correlation with a signature data bank
All-weather operation	Microwave SAR or millimeter wave radar
Protection against enemy anti-radiation missiles	Sparing use of active sensors, and shifts in frequency to new regions of the spectrum

TABLE 3. Communications and Navigation

Communications

Communications is an increasingly vital function, particularly in insuring "connectivity" among command levels in a large-scale attack.

Mission Need	Technical Approach
Channels that resist jamming and interception	<p>Spread spectrum, noise-simulation coding</p> <p>Fast frequency hopping and burst propagation</p> <p>Antenna pattern nulling and side-lobe cancellation</p> <p>Use of unused, millimeter-wave region of the spectrum</p> <p>Fiberoptic cable transmission</p>
Protection against electromagnetic pulse (EMP) and other radiation	<p>Shielding of sensitive receiver components</p> <p>Use of optical systems in place of electrical systems</p>
Wide-band, lightweight links	Fiberoptics at wavelengths that minimize attenuation and dispersion

TABLE 3 CONTINUED

Navigation

New navigation concepts include improved inertial navigation and sensors that require external inputs. Terrain following and obstacle avoidance are also areas for improvements.

Mission Need	Technical Approach
Low maintenance, low-cost inertial	Replacement of mechanical gyros with a ring laser gyro, all electronic system to provide medium accuracy sufficient for tactical missions
World navigation	Use of satellite-based global positioning system (GPS) that has an onboard time standard and sends precisely timed, coded radio signals from a multiplicity of satellites to receivers on planes and ships
Low-altitude flight	Use of nap-of-the-earth navigation by means of terrain-following microwave and millimeter wave radar; use of high resolution laser radar to avoid small obstacles such as wires
Cruise missile navigation	Altimeter profile comparison with stored path data

TABLE 4. Command and Control

Advanced command and control concepts involve integrating all source data, determining data significance, and communicating the desired action to the field.

Mission Need	Technical Approach
All-digital systems for sensor data stream integration	Analog to digital conversion at sensor; multiple bus architecture  Integrated avionics systems
Data presentation in spatially confined quarters	Flat panels to replace cathode-ray tube  Helmet mounted displays  Synthesized speech for emergencies
Improved decision aids	Extension of data buses by use of target signatures, deployment information, and terrain conditions  Algorithms to query such bases and correlate responses
Reduced vulnerability of command structure	Network with distributed processing capability



TABLE 5. Electronic Warfare

Electronic warfare (EW) activity consists of three types: (1) passive measures designed to shield the US forces from enemy observation, (2) warning receivers designed to detect an enemy's electronics threat, and (3) active countermeasures aimed at jamming an enemy's system or giving deceptive or false target information.

Mission Need	Technical Approach
Radiation detection and sorting in a dense signal environment	High-speed, real-time spectrum analysis by use of acousto-optic processing for 100 to 1,000 simultaneous spectral outputs
Standoff jammer for wide-area penetration of enemy radar with minimum risk to the attacking force	Programmable high-power broadband microwave amplifiers High-gain radiators
Extension of ECM spectrum coverage to millimeter and optical wave lengths	Development of tunable components of suitable power covering these ranges
Decoys	Expendable jammers Chaff Pyrophoric flares
Warning of illumination	Laser-warning receiver
Obscuration aids	Aerosols Smokes effective over optical and infrared spectra
Radar and IR cross-section reduction	Stealth concepts, such as absorptive coatings and paints, and structure geometrics that avoid high reflection

TABLE 6. General Support Technologies

Advanced electron devices and components and advanced information processing are key developments that span the breadth of weapon technologies. The major information processing development is the standard high-order language, Ada. Program support for Ada is now in development. An overriding problem, however, is programmer productivity.

For electron devices, the following table gives some examples of current technology efforts.

Goal	Technical Approach
Real-time, high-speed signal processing	<p>Digital: VHSIC submicrometer silicon technology; gallium arsenide for even higher speed and strategic levels of radiation hardening</p> <p>Analog: surface acoustic wave (SAW) charge coupled devices (CCDs) for correlators and filters; acoustooptic Bragg cell diffraction for spectrum analyzers and correlators</p>
Affordable microwave-phased array	Monolithic solid-state transmit and receive modules, including digital phase shifter